UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

Refer to:
2001/01421

May 2, 2003

Ms. Penny Dunn Woods
Vale District Manager (Acting)
U.S. Bureau of Land Management
100 Oregon Street
Vale, OR 97918

Re: Endangered Species Act Formal Section 7 Consultation and Magnuson-Stevens Fishery Conservation and Mangement Act Essential Fish Habitat Consultation, Integrated Noxious Weed Management Program for FY2003-2013, Bureau of Land Management Vale District, Union, Wallowa, Grant, and Umatilla Counties, Oregon

Dear Ms. Dunn Woods:

Enclosed is a document prepared by NOAA's National Marine Fisheries Service (NOAA Fisheries) pursuant to section 7 of the Endangered Species Act (ESA) for the proposed Integrated Noxious Weed Program for FY2003-2013 for the Vale District, Oregon. In this biological opinion (Opinion), NOAA Fisheries concludes that the proposed action is not likely to jeopardize Snake River (SR) spring/summer chinook salmon (*Oncorhynchus tshawytscha*), SR fall chinook salmon, SR steelhead (*O. mykiss*), Middle Columbia River (MCR) steelhead, or destroy or adversely modify designated critical habitat. As required by section 7 of the ESA, NOAA Fisheries has included reasonable and prudent measures with non-discretionary terms and conditions that NOAA Fisheries believes are necessary and appropriate to minimize the potential for incidental take associated with this action.

This document also serves as consultation on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act and its implementing regulations (50 CFR Part 600). The Upper Grande Ronde, Lower Grande Ronde, Wallowa, Walla Walla, and North Fork John Day River subbasins have been designated as EFH for chinook salmon.

If you have questions regarding this consultation, please call Randy Tweten of my staff in the Oregon Habitat Branch at 541.975.1835, ext 229.

Sincerely,

For Michael R Crouse

D. Robert Lohn
Regional Administrator

cc: Alison Beck-Haas, USFWS
Dorothy Mason, BLM
Gary Miller, USFWS

Endangered Species Act - Section 7 Consultation
Biological Opinion

&

Magnuson-Stevens Fishery Conservation and Management Act
Essential Fish Habitat Consultation

Integrated Noxious Weed Management Program FY2003-2013,
Snake River, Middle Columbia River,
and John Day River Basins, Oregon

Agency: USDI Bureau of Land Management

Consultation Conducted By: NOAA's National Marine Fisheries Service, Northwest Region

Date Issued: May 2, 2003

Issued by: for Michael R Crouse

D. Robert Lohn
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1. INTRODUCTION

1.1 Consultation History

On May 4, 2001, NOAA's National Marine Fisheries Service (NOAA Fisheries) received a letter from the Bureau of Land Management (BLM) dated February 7, 2001, requesting Endangered Species Act (ESA) section 7 consultation regarding the effects of the actions associated with the Integrated Noxious Weed Management Program for FY2003-2013 on Snake River (SR) fall chinook salmon (*Oncorhynchus tshawytscha*), SR steelhead (*O. mykiss*), Middle Columbia River (MCR) steelhead, and SR spring/summer chinook salmon and their designated critical habitat. ESA consultation for SR fall chinook salmon, SR steelhead, and SR spring/summer chinook salmon and their designated critical habitat was previously completed for the BLM's Integrated Noxious Weed Treatment Program in the portions of the Upper Grande Ronde River Subbasin, Lower Grande Ronde River Subbasin, and Wallowa River Subbasin managed by the Vale District. These consultations expired January 15, 2002.

Prior to requesting consultation on May 4, 2001, a conditional effects determination was made by a consultation team (Team) comprised of representatives from the BLM and U.S. Fish and Wildlife Service (FWS). The Team followed procedures described in *Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale* (NOAA Fisheries 1996), and determined that the physical, cultural, and mechanical control methods may effect, but are "not likely adversely affect" (NLAA) SR fall chinook salmon, SR steelhead, MCR steelhead, or SR spring/summer chinook salmon and their designated critical habitat. The Team determined that chemical control methods may affect, and are "likely to adversely affect" (LAA) the aforementioned species and their designated critical habitat, and consequently initiated formal consultation for this portion of the project.

The action area considered in this document consists of all BLM lands in the Vale District, the rivers and streams potentially receiving herbicide inputs through direct contamination, runoff, or percolation, and those waters downstream from BLM lands that may contain more than negligible herbicide concentrations as a result of the proposed action. The action area is defined as all areas (bankline, adjacent riparian zone, and aquatic area) to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The subbasins comprising the action area are the Upper Grande Ronde, Lower Grande Ronde, Wallowa, North Fork John Day, and Walla Walla. The remainder of the Vale District contains no anadromous fish. The Vale District consists of over five million acres of land, primarily in eastern Oregon.

The BLM has determined that SR spring/summer chinook salmon, SR fall chinook salmon, SR steelhead, and MCR steelhead may occur within the project area. SR steelhead were listed as threatened on August 18, 1997, (62 FR43937), and SR spring/summer chinook salmon were listed as threatened on April 22, 1992, (57 FR 14653). The proposed project is within critical habitat for SR spring/summer and fall chinook salmon, both designated on December 28, 1993, (58 FR 68543). MCR steelhead were listed as threatened on March 25, 1999 (64 FR 14517).

Protective regulations for SR steelhead and MCR steelhead were issued under section 4(d) of the ESA on July 10, 2000, (65 FR 42422).

Upon completion of the first draft of this document in April 2002, the Vale District was provided with draft versions of the reasonable and prudent measures and terms and conditions included in the incidental take portion of this document. The Vale District had several concerns regarding the draft terms and conditions. After attempts to resolve these issues were unsuccessful at the local level, the Vale District elevated the issues to an Interagency Coordination Subgroup (ICS) for resolution. The ICS convened on December 2, and 3, 2002, to address the elevated issues and provided recommendations on January 31, 2003. In response to the ICS recommendations, the Vale District provided clarification and additional information on March 18, 2003. Included in this information was a list of sites to be treated with herbicides in 2003. The riparian area to be treated in 2003 will not exceed 47 total acres with no aerial treatment planned for riparian areas. The Vale District also agreed to provide to NOAA Fisheries, a list of site to be treated before each year's field season.

NOAA Fisheries' level of concern with the effects of the proposed action to listed salmon and steelhead was greatly reduced when it learned that the area to be treated by aerial spraying of herbicides would not exceed 50-60 acres each year for a total application of 500-600 acres over ten years. On March 18, 2003, the Vale District provided NOAA Fisheries the locations to be treated during FY2003.

The objective of the biological opinion contained in this document is to determine whether implementing the activities included in the Integrated Noxious Weed Management Program are likely to jeopardize the continued existence of SR spring/summer chinook salmon, SR fall chinook salmon, SR steelhead, and MCR steelhead, or adversely modify designated critical habitat.

The objective of the EFH consultation is to determine whether the proposed action may adversely affect designated EFH for relevant species, and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH resulting from the proposed action.

1.2 Proposed Action

The BLM's goals for managing noxious weeds are to prevent and eradicate new invaders, and to control established infestations. The proposed action is designed to achieve these goals by implementing a 10-year integrated noxious weed management program on BLM-administered lands within the Vale District in northeast Oregon. The proposed action would involve one or a combination of management approaches including physical, cultural, biological, and chemical methods to control noxious weeds. Detailed accounts of targeted noxious weeds and their biology and habitat is provided in the draft EA for this program (USDI 2000). Table 1 lists priority noxious weeds to be treated and estimated yearly acreage by treatment type.

Determining which method(s) to use, when and how often, will be based on (but not limited to) the following factors: (1) Physical growth characteristics of target weeds (rhizomatous vs. tap-rooted, *etc.*); (2) seed longevity and germination; (3) infestation size; (4) relationship of the site to other infestations; (5) relationship of the site to listed species and/or proposed for listing under the ESA,; (6) distance to surface water; (7) accessibility to site for equipment; (8) type and amount of use of the area by people; (9) effectiveness of treatment on the target weed; and (10) cost. Due to these various factors, one or several treatment methods may be needed in a given area for 10 or more years.

Physical, cultural, and biological treatments are used to the extent that they are practical, but tend to be less effective and more costly than chemical treatments. Physical treatments have limited effectiveness because they often fail to remove noxious weed roots. This type of treatment is costly, and feasible only in small areas. Cultural controls can be effective in preventing new invasions of noxious weeds during management and recreational activities, but do little to eliminate existing weed infestations. Biological controls have promise in noxious weed management, and are currently being used by the BLM. The BLM is using insects for control of yellow star thistle, diffuse knapweed, leafy spurge, and rush skeletonweed. A biological control agent for dalmation toadflax is currently being tested on National Forest land that may be employed on BLM lands within three to five years. However, these insects take many years to establish a population sufficient to control a given noxious weed infestation, and they are not effective in all environments. The use of grazing for weed control is not currently available to the BLM. National Environmental Policy Act (NEPA) analysis, re-structuring of grazing plans, and ESA consultation will be required before implementing this control method. Chemical controls are the cheapest and most effective at controlling noxious weeds. The BLM considers chemical controls the only way to stop the current rate of noxious weed spread in eastern Oregon. Therefore, the vast majority of noxious weed treatment associated with the proposed action will be done with chemical controls. The following describes what each control method entails.

<u>Physical Control</u>.
This control method will include:

1. Manual. Hand pulling and grubbing with hand tools, bagging plant residue for burning or other proper disposal. Hand-operated power tools, such as chain saws, may also be used.
2. Mechanical. Mowing, tilling, discing, plowing, or competitive seedbed preparation.
3. Prescribed fire. Used as a site-preparation tool rather than for weed control; conducted in accordance with the Wildland and Prescribed Fire Management Policy (USDI/USDA 1998), which requires analysis of impacts through NEPA (including potential impacts to listed and proposed species), and the preparation of a prescribed burn plan before ignition.

Table 1. Current List of Priority Noxious Weeds and Estimated Typical Annual Treatment (USDI 2000)

Species		Treatment Type		
		Herbicide	Biological	Physical
Common Name	**Scientific Name**	**Approx. acreage**	**Sites**	**Acreage**
Mediterranean sage	*Salvia aethoiopis*	5.0	-	-
Puncture vine	*Trebulus terrestris*	5.0	-	-
Medusahead	*Taeniatherum caputmedusae*	100-200	-	-
Spotted knapweed	*Centaurea maculosa*	20-50	TBD	-
Russian knapweed	*Centaurea repens*	10-20	TBD	-
Canada thistle	*Cirsium arvense*	0-10	-	-
Bull Thistle	*Cirsium vulgare*	0-10	-	-
Scotch thistle	*Onopordum acanthium*	1-50	-	10
Perennial pepperweed	*Lepidium latifolium*	5-50	-	-
Whitetop	*Cardaria species*	150-300	-	-
Klamath weed	*Hypericum perforatum*	5-20	TBD	-
Leafy spurge	*Euphorbia esula*	300	10	5
Buffalo bur	*Solanum rostatum*	5	-	-
Dalmatian toadflax	*Linaria dalmatica*	20-50	-	-
Jointed goatgrass	*Aegilops cylindrica*	1.0	-	-
Black henbane	*Hycoscyamus niger*	1.0	-	-
Yellow starthistle	*Centaurea solstitialis*	300-900	10	TBD
Tansy ragwort	*Senecio jacobaea*	0-5	-	-
Diffuse knapweed	*Centauria* diffusa	100-300	10	10
Sulfur cinquefoil	*Pontentilla recta*	--	-	-
Rush skeletonweed	*Chondrilla juncea*	50-200	10	5
Saltcedar (tamarisk)	*Tamarix* sp.	1-10	-	-
Total		**1,080 to 2,483**		**30 est**

<u>Cultural Control</u>.
This control method includes preventing weed introduction and/or minimizing rate of spread by requiring the following actions on public lands:

1. Clean all equipment moving into or out of weed infested areas before and after use.
2. Use only certified, noxious weed-free grains, hay or pellets for feeding domestic animals and wildlife, and inspect all feeding sites during and following use.
3. Use only certified noxious weed-free seed, along with hay, straw, mulch, or other vegetation material for site stability and revegetation projects.
4. Use only noxious weed-free gravel and fill material from inspected sites.
5. Revegetate disturbed areas as soon as practical, and use temporary fencing if required to assure new seedling establishment.
6. Evaluate current and proposed vegetation management practices (*i.e.* livestock grazing, prescribed burning, seeding), and implement practices to restore desired plant communities.
7. Close areas to vehicle access if they are the primary cause of noxious weed introduction and/or spread.

Biological Control.
This control method includes the use of insects, pathogens, or some combination of the two, and grazing by cattle, sheep and/or goats. The purpose of biological control is not complete removal, but to reduce target species to a negligible status. A list of insects and pathogens proposed for use are found in Appendix V of the draft EA (USDI 2000). Introductions of all biological control agents would be done in accordance with the guidelines provided by the U.S. Department of Agriculture - Animal and Plant Health Inspection Service, Oregon, and Washington State's Department of Agriculture, and BLM Manual 9014 - Biological Pest Control.

1. Only those insects and pathogens determined to be host specific, highly damaging to targeted species, able to survive in the host's habitat, free of natural parasites and not likely to be parasitized in the host plant's habitat would used. To bring a target species to economic treatment levels, it may take five or more insects, and 15 - 20 years to build up sufficient insect populations.
2. Grazing, coordinated with range management plans, would address the class of livestock, numbers, timing, intensity and duration required to treat target weed species. This proposed action requires analysis of impacts through NEPA (including potential impacts to listed and proposed species and their habitats), and will be evaluated in a separate ESA consultation.

Chemical Control.
This control method involves herbicide use. The BLM is currently restricted in Oregon to the use of four herbicides and four herbicide combinations (Table 2), due to a court injunction restricting the use of other herbicides. Vale District lands within Washington are not affected by this injunction, but the BLM is voluntarily limiting chemical weed treatments to the same four herbicides within Washington state. The Integrated Noxious Weed Management Program proposes the use in Washington and Oregon of an additional seven herbicides, plus three combinations of those herbicides, should the injunction be lifted. However, chemicals subject to the injunction are not considered in this document. Prior to using other herbicides, reinitiation of

consultation will be necessary. The use and effects of all herbicides proposed for use, were addressed in the Final EIS for Vegetation Treatment on Public Lands in Thirteen Western States (USDI 1991).

Table 2. Herbicides and Herbicide Combinations Evaluated in this Opinion

Herbicides	**Herbicide Combinations**
2,4-D	Dicamba + 2,4-D
Dicamba	Glyphosate + 2,4-D
Glyphosate (Rodeo formulation only)	Glyphosate + Dicamba
Pilcoram	Picloram + 2,4-D

During implementation of the weed control program, herbicide treatment of noxious weeds on BLM lands may occur annually on approximately 1,000 - 2,500 acres. Herbicide use within riparian areas of any subbasin containing listed fish is not expected to exceed 50 acres annually. At least half of the of treated riparian acres will be on upland sites that fall within the an area of riparian area of influence, but not actually within areas with riparian vegetation. Over half of these acre on the Vale District administered lands are not within anadromous salmonid habitat. Table 3 illustrates approximate expected annual treatment acres, types and amounts of chemicals, and treatment timing within watersheds containing steelhead and/or salmon habitat by watershed. This estimate is based on known noxious weed infestations. Actual acres treated in the future would depend on funding, inventory, new technology, and the success of proposed control and management practices. The BLM expects that a successful treatment program, including seeding of native grass species, will result in fewer and smaller noxious weed infestations, resulting in a reduction of acres requiring herbicide use over the next 10-year period (and beyond).

Table 3. Expected Annual BLM Noxious Weed Treatment by Watershed

Subbasin	Noxious Weed Species	Approx. Acres Treated Annually	Treatment Location Within Watershed	Life Stage of fish in Spray Area	Chemical and Amount (lbs.)	Treatment/ Timing
Lower Grande Ronde	Yellow Starthistle	50 (ground) 0 up to 200 (aerial*)	Lower and Middle	CH: juv ST: adult/juv	Picloram < 50 0 to 150*	Spring / Early Summer
	Diffuse Knapweed	50	Lower Middle Upper	CH: ad/juv ST: ad/juv	Picloram < 50	Spring / Fall
	Rush Skeleton-weed	Spot treat < 10 < 5	Lower Middle	CH: ad/juv ST: ad/juv	Picloram 10 5	Spring / Mostly Fall
	Dalmatian Toadflax	Spot treat < 20	Lower and Middle	CH: ad/juv ST: juv	Picloram < 20	Mostly Fall
	Leafy Spurge	Spot treat < 25	Mostly Upper; some middle	CH: ad/juv ST: juv	Glyphosate (Rodeo formulation) < 60	Summer / Fall
	Misc. species: Scotch thistle, Sulfur cinquefoil, etc.	Spot treat < 20	Lower Middle Upper	CH: ad/juv ST: ad/juv	Picloram < 20 2,4-D < 60 Dicamba < 40	Spring Summer Fall
Upper Grande Ronde	Diffuse Knapweed	< 15	Lower	CH: juv ST: ad/juv	Picloram < 15	Spring
	Sulfur Cinquefoil	< 10	Lower	CH: juv ST: ad/juv	Picloram < 10	Spring
	Misc. species: Scotch thistle, etc.	Spot treat < 20	Lower Middle Upper	CH: ad/juv ST: ad/juv	Picloram < 20 2,4-D < 60 Dicamba < 40	Spring Summer Fall
Wallowa	Diffuse Knapweed	<10	Lower	CH: juv ST: ad/juv	Picloram < 10	Spring
	Sulfur Cinquefoil	< 10	Lower	CH: juv ST: ad/juv	Picloram < 10	Spring
	Misc. species: Scotch thistle, etc.	Spot treat < 20	Lower Middle Upper	CH: ad/juv ST: ad/juv	Picloram < 20 2,4-D < 60 Dicamba < 40	Spring Summer Fall
Lower Snake-Asotin	Yellow Starthistle	10 - 50	------------	CH: juv ST: ad/juv	Picloram 10 < 50	Spring / Early Summer

Subbasin	Noxious Weed Species	Approx. Acres Treated Annually	Treatment Location Within Water-shed	Life Stage of fish in Spray Area	Chemical and Amount (lbs.)	TreatmentTiming
	Diffuse Knapweed	Spot Spray < 10	-------------	CH: ad/juv ST: ad/juv	Picloram < 10	Spring / Fall
	Rush Skeleton-weed	Spot Spray 10 - 20	-------------	CH: ad/juv ST: ad/juv	Picloram 10 to 20	Spring / Fall
	Misc. species: Scotch thistle, Sulfur cinquefoil, etc.	Spot treat < 20	Lower Middle Upper	CH: ad/juv ST: ad/juv	Picloram < 20 2,4-D < 60 Dicamba < 40	Spring Summer Fall

* No aerial spraying was done in 2001 and only 60 acres in 2000. However, 40 up to possibly 200 total acres could be sprayed in any given year within the watershed. BLM anticipates fewer aerial spray projects in the future but intends to keep this method available if conditions warrant.

It is evident that a large percentage of herbicide application will be picloram. Picloram is preferred by the BLM where stream buffers are sufficient because: (1) Picloram is persistent in the soil for approximately one year, which prevents the need for re-treating of isolated sites within the year to kill adjacent germinating noxious weed plants; and (2) when applied at Environmental Protection Agency (EPA)- and BLM-recommended concentrations, picloram kills broadleaf weeds but will not harm grasses. This will allow native grasses to occupy a site that has been sprayed. By contrast, glyphosate, although short-lived, will kill grasses and broadleaf plants.

Herbicide use requirements, including selection factors, maximum rates and mitigation measures (Best Management Practices [BMPs]), are shown in Appendix I of the draft EA (USDI 2000). Appendix C of the BLM's November, 2001 biological assessment (BA) lists BMPs, including those specific to herbicide application in watersheds with listed/proposed aquatic species and critical habitat (Table C-1). These BMPs are listed below in section 1.2.1.

Application Methods.
Liquid or granular forms of herbicides will be applied either from the air or on the ground. Aerial applications are made from helicopters using boom-mounted nozzles for liquids or rotary broadcasters for granular formulations. Ground application will be either mechanized or by hand. Mechanized ground application would be done with vehicle-mounted (pick-up or 4-wheeler) fixed-booms, approximately four to12 feet in length. Hand application methods will include: (1) Spot-spraying with hand-held spray nozzles either mounted on a vehicle or attached to a backpack system; (2) hand-spreading granular formulations; and (3) wicking, wiping, dripping, painting, or injecting target weeds. All application methods may be used for each herbicide and herbicide combination with the exception of glyphosate and glyphosate mixes, which will not be applied aerially.

Monitoring.
The BLM proposes to monitor the noxious weed treatments for their effectiveness on weed eradication, on both a site-specific treatment level and on a landscape level. Site-specific monitoring will include checking sites for treatment effects to both target and non-target species. Landscape level monitoring involves tracking all noxious weed sites in the BLM Geographic Information System (GIS). No monitoring is proposed for the effects of the proposed action on listed fish, due to uncertainty over how to monitor, availability of funding for monitoring, and how to interpret the results. The BLM proposes to further investigate the effectiveness and practicality of conducting some level of water quality monitoring to detect cumulative (*i.e.* levels of chemicals in the system from various upstream private, state, and Federal landowners) and baseline levels of herbicides and possibly to establish the effectiveness of the drift buffers.

Adaptive Management.
The noxious weed control program is a long-term endeavor to control weeds where and when practicable. However, because there are areas of scientific and management uncertainty about the effectiveness of weed control treatments, the proposed action may be refined over time to meet the basic objective of systematically reducing noxious weed abundance, and their extent and spread throughout the Vale District. The proposed action will be reevaluated on a 10-year cycle (life of the BA) or if consultation is reinitiated. Information from weed inventories and results from treatments will be mapped spatially, and the BLM will use this information to assess the noxious weed program objectives and can use this information to build a current baseline for future ESA/EFH consultations.

Annual Program Reports.
The acreage proposed for treatment each year in areas with a potential to affect listed/proposed species and critical habitats will be included in annual monitoring reports submitted to NOAA Fisheries.

1.2.1 BLM's Best Management Practices for Herbicide Application

Note: Water or waters, by definition, refer to perennial, intermittent, ephemeral stream channels, lakes, reservoirs, ponds, meadows, springs, seeps and bogs.

Buffers.
1. Minimum buffer strips will meet or exceed state-mandated standards for all applied herbicides.
2. No aerial application within 100 feet of any surface waters or identified groundwater recharge areas.
3. Aerial applications will maintain a 500-foot unsprayed buffer next to inhabited dwellings unless waived in writing by the resident. A minimum buffer strip of 100 feet would be left next to cropland and barns.
4. Broadcast application using boom sprayers will not occur within 25 feet of any waters.
5. Spot spraying from backpacks or vehicle-mounted handguns will not occur within 10 feet of any waters.

6. Ground application within 10 feet of any waters will only be done by hand wicking, wiping, dripping, painting or injecting.
7. See Table 4 for specific aquatic buffers.

Wind Speed Restrictions and Weather Considerations.
1. Aerial (helicopter) application will only occur when winds do not exceed five miles per hour (mph).
2. Winds may not exceed eight mph under any application method except wicking, wiping, dripping, painting or injecting.
3. During application, weather conditions will be monitored hourly by trained personnel at spray sites. Additional weather monitoring will occur whenever a weather change may affect safe placement of the herbicide on the target area.

Equipment Handling.
1. Herbicides will be mixed and loaded in areas where accidental spills cannot flow into waters, or contaminate groundwater.
2. Regular testing on field calibration and calculation will take place to prevent gross application errors.
3. Spray tanks will not be washed or rinsed in or near waters. All chemical containers will be disposed of at sites approved by the Oregon State Department of Environmental Quality.

Additional Safeguards.
1. Only aquatic-approved herbicides[1] will be used if soils are wet, and adjacent to any waters.
2. No more than one application of picloram will be made on a given site in any given year to reduce the potential for picloram accumulation in the soil
3. Due to the remote nature of treatment areas, sufficient clean water will be available on sprayer mixing and project sites for applicators to wash off any chemical splashed inadvertently onto skin.
4. If an application is made in areas frequented by people (*i.e.* hiking, camping, working), the area would be posted to prevent any post treatment contamination.

Additional Measures Specific to Watersheds With Listed/Proposed Fish Species and Critical Habitat.
1. Treatment will be delayed if precipitation is forecasted to occur within 24 hours.
2. Any use of the Rodeo formulation of glyphosate will be without a adjuvant unless the adjuvant is specifically approved for aquatic use by EPA on the label.
3. No ester formulations of 2,4-D will be used within 0.25 miles of waters.
4. No carrier other than water will be used.
5. Broadcast spraying within 25 feet of waters will cease if wind speeds exceed five mph.

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[1]NOAA Fisheries understands this to mean that glyphosate will be used.

6. Wicking, wiping, dripping, painting, or injecting will not occur near water if winds exceed 15 mph.
7. All aerial applications will be on the contour, parallel to stream drainages. No turns will be allowed over live waters even though booms are turned off at the end of each run.
8. All aerial applications that include an adjuvant will comply with the highest required buffer, depending on the Quotient Value (QV), or level of concern determined for the herbicide or adjuvant.

Table 4. Summary of Buffers* and Maximum Wind Speeds for Herbicide Treatment of Noxious Weeds in Association with Listed and/or Proposed Aquatic Species

Buffer	Maximum Wind Speed	Herbicide Application Method for Noxious Weed(s)
100 feet	5 mph	aerial (helicopter) (herbicides **and** adjuvants with a low level of concern)
150 feet	5 mph	aerial (helicopter) (herbicides **and/or** adjuvants with a moderate level of concern)
200 feet	5 mph	aerial (helicopter) (herbicides **and/or** adjuvants with a high level of concern)
0.25 mile (1320 feet)	5 mph	aerial (helicopter)/if 2,4-D ester formulations are used
50 feet	8mph	ground/broadcast spraying
25 feet	5 mph	ground/broadcast spraying
10 feet	8 mph	ground/spot spraying
0	15 mph	wicking, wiping, dripping, painting, injecting

* Buffers are based on the delineated 'greenline' boundary for all waters (perennial, intermittent, ephemeral, lakes, reservoirs, ponds, springs, seeps, bogs, wetlands). The greenline is defined as that specific area where a more or less continuous cover of vegetation is encountered when moving away from the center of an observable channel (USDI 1993).

Additional BMPs Specific to Riparian Conservation Areas.

Herbicide application that occurs in Riparian Conservation Areas (as defined by PACFISH/INFISH guidelines) (U.S.D.A. and U.S.D.I 1994) (RCAs) will be followed by seeding native perennials to stabilize soils. If effectiveness monitoring during subsequent years indicates native herbaceous or woody perennial mortality, reseeding and/or planting of woody species will occur to ensure soil stabilization.

Herbicide application requires a Pesticide Use Proposal (PUP). Herbicides will only be applied by a licensed applicator and only in accordance with EPA labeling. Applicators will use the herbicide specifically targeted for a particular weed species, causing the least affect to non-target vegetation.

2. ENDANGERED SPECIES ACT

2.1 Biological Opinion

2.1.1 Biological Information

The listing status, critical habitat designation, and protective regulations for the ESUs addressed in this biological opinion (Opinion) are summarized in Table 5.

Table 5. Listing Status, Critical Habitat Designation, and Protective Regulations for Listed Species Addressed in this Opinion

ESU	Listing Status	Critical Habitat	Protective Regulations
SR Fall Chinook	Threatened 4/22/1992 57 FR 14653	12/28/1993 58 FR 68543	7/22/1992 57 FR 14653
SR Spring/Summer Chinook	Threatened 4/22/1992 57 FR 14653	12/28/1993 58 FR 68543	4/22/1992 57 FR 14653
SR steelhead	Threatened 8/18/1997 62 FR 43937	withdrawn	7/22/2000 65 FR 42423
MCR steelhead	Threatened 3/25/1999 64 FR 14517	withdrawn	7/22/2000

<u>SR Fall Chinook</u>.
SR fall-run chinook salmon remained stable at high levels of abundance through the first part of the twentieth century, but then declined substantially. Because genetic analyses indicate that fall-run chinook salmon in the Snake River are distinct from the spring/summer-run in the Snake River basin (Waples *et al.* 1991), SR fall-run chinook salmon are considered separately from the other two forms. They are also considered separately from those assigned to the UCR summer- and fall-run ESU because of considerable differences in habitat characteristics and adult ocean distribution and less definitive, but still significant, genetic differences. There is, however, some concern that recent introgression from Columbia River hatchery strays is causing the Snake River population to lose the qualities that made it distinct for ESA purposes.

Although the historical abundance of fall-run chinook salmon in the Snake River is difficult to estimate, adult returns appear to have declined by three orders of magnitude since the 1940s, and perhaps by another order of magnitude from pristine levels. Irving and Bjornn (1981) estimated that the mean number of fall-run chinook salmon returning to the Snake River declined from 72,000 during the period 1938 to 1949, to 29,000 during the 1950s. Further declines occurred upon completion of the Hells Canyon Dam complex, which blocked access to primary production areas in the late 1950s (see below).

Fall-run chinook salmon in this ESU are ocean-type. Adults return to the Snake River at ages two through five, with age four most common at spawning (Chapman *et al.* 1991). Spawning, which takes place in late fall, occurs in the mainstem and in the lower parts of major tributaries (NWPPC 1989; Bugert *et al.* 1990). Juvenile fall-run chinook salmon move seaward slowly as subyearlings, typically within several weeks of emergence (Chapman *et al.* 1991).

With hydrosystem development, the most productive areas of the Snake River basin are now inaccessible or inundated. The upper reaches of the mainstem Snake River were the primary areas used by fall-run chinook salmon, with only limited spawning activity reported downstream from river kilometer (Rkm) 439. The construction of Brownlee Dam (1958; Rkm 459), Oxbow Dam (1961; Rkm 439), and Hells Canyon Dam (1967; Rkm 397) eliminated the primary production areas of SR fall-run chinook salmon. There are now 12 dams on the mainstem Snake River, and they have substantially reduced the distribution and abundance of fall-run chinook salmon (Irving and Bjornn 1981).

The Snake River has contained hatchery-reared, fall-run chinook salmon since 1981 (Busack 1991). The hatchery contribution to Snake River escapement has been estimated at greater than 47 % (Myers *et al.* 1998). Artificial propagation is recent, so cumulative genetic changes associated with it may be limited. Wild fish are incorporated into the brood stock each year, which should reduce divergence from the wild population. Release of subyearling fish may also help minimize the differences in mortality patterns between hatchery and wild populations that can lead to genetic change (Waples 1999).

Some SR fall-run chinook historically migrated over 1,500 km from the ocean. Although the Snake River population is now restricted to habitat in the lower river, genes associated with the lengthier migration may still reside in the population. Because longer freshwater migrations in chinook salmon tend to be associated with more-extensive oceanic migrations (Healey 1983), maintaining populations occupying habitat that is well inland may be important in continuing diversity in the marine ecosystem as well.

<u>SR Spring/Summer Chinook Salmon</u>.
The current status of SR spring/summer chinook salmon ESU has improved somewhat since being listed as threatened in 1992. In 1994, the species was proposed for listing as endangered due to very low numbers of adults observed at Lower Granite Dam on the lower SR. However, an improvement in the adult return levels, as seen in 1997, promoted the withdrawal of the proposed rule of endangered status in 1998. Recent returns show continuing improvements in

adult returns, at least for some portions of the ESU. The counts at Lower Granite Dam for spring/summer chinook were 14,320 in 1998, 6,556 in 1999, 37,755 in 2000, and 185,963 in 2001. Lower Granite Dam is at river mile (RM) 107.5 on the mainstem of the Snake River, about 70 miles downstream of the confluence of the Grande Ronde and Snake Rivers.

SR spring/summer chinook use larger streams for spawning. These include the Grande Ronde, Wallowa, Minam, Lostine, Wenaha, and Imnaha Rivers, and Catherine and Lookingglass Creeks. Early juvenile rearing occurs in these larger streams and the lower reaches of their major tributaries. They migrate to sea as yearling smolts. The returning spring-run chinook reach the Snake River in April, whereas returning summer-run adult chinook reach the Snake River in July. Peak spawning for both spring and summer chinook is in the fall (mid-August through September). The Grande Ronde River basin contains spring and summer runs of chinook salmon. Populations from this ESU mature at ages four and five, and are rarely taken in ocean fisheries.

SR Steelhead.
SR steelhead, listed as threatened in 1997, and MCR steelhead, listed as threatened in 1999, have shown some recent improvement, although the data for wild fish are insufficient to draw any conclusions about trends. The recent improvement in run sizes over the last few years is encouraging. However, escapement levels are well below what is needed to fully seed rearing habitat (USDI 2001). During 1990-1995 the percentage of wild origin steelhead migrating above Lower Granite dam averaged 14% of the total run. The majority of steelhead in the SR system are of hatchery origin. Data for the past 10 years indicate that the hatchery origin steelhead continue to outnumber the wild fish in both SR and MCR ESUs.

Steelhead are found in nearly all fish-bearing streams that flow into the Snake River (below Hells Canyon Dam), the Grande Ronde River, and the North Fork John Day River. Adult steelhead enter the Columbia River in the spring, and migrate upriver through the summer, fall, and winter, seeking their tributary of origin. By early the following spring adults have reached their natal streams and spawn in gravel from March to early June. Deposited eggs usually hatch by late July. The juveniles will spend from one to four years rearing to smolt size, at which time they will begin their migration to the ocean. Juvenile steelhead are expected to be rearing in the project area during all phases of the proposed project. Detailed information on the current range-wide status of SR steelhead, under the environmental baseline, is described in steelhead status review (Busby *et al.* 1996), status review update (BRT 1997), and the draft Clearwater Subbasin Summary (CBFWA 2001).

MCR Steelhead.
The MCR steelhead occur in the John Day, Umatilla, and Walla Walla Rivers within the BLM Baker Resource Area. MCR steelhead adults enter the John Day River as early as September, with peak migration in October, depending on water temperature. Spawning in the John Day basin occurs from March to mid- June. Fry emergence timing depends on time of spawning and water temperature during egg incubation, but usually occurs from late May through June. MCR steelhead rear in the cooler tributary streams and in the mainstem John Day River upstream from

the City of John Day, Oregon (RM 248). High summer water temperatures in the mainstem downstream from Mt. Vernon, Oregon (RM 240) preclude summer rearing by juvenile salmonids.

Trend data for MCR steelhead in the North Fork John Day River (NFJDR) show a decline in the MCR steelhead population. The BA simply references a decline in steelhead production while Busby *et al.* (1999) note a short-term decline of -1.2%, and a long-term decline of -2.5. A decline of MCR steelhead in the John Day basin is of particular concern because the basin has historically supported the largest population of native, naturally-spawning summer steelhead in the MCR ESU. Busby (1996), citing ODFW data, stated that the total MCR steelhead run size for the John Day River basin has recently averaged about 5,000 fish. NOAA Fisheries (1997) citing Chilcote (1997) states that recent MCR steelhead redd counts conducted in established index areas throughout the John Day River basin suggest universal declines in redd abundance ranging from -0.9 to -5.6% over the past several years. NOAA Fisheries (1999) updated the estimate of total summer steelhead run size in the John Day River basin to 10,000 fish through 1994. Annually declining trends of -1.2% in the short term, and -2.5% in the long term were noted for MCR steelhead in the North Fork John Day River (NOAA Fisheries, 1999). Detailed information on the current range-wide status of MCR steelhead is described in steelhead status review (Busby *et al.* 1996), and status review update (Busby *et al.* 1999), and the *Interior Columbia Basin Ecosystem Management Project Science Assessment* (ICBEMP 1997).

Steelhead production has decreased in the North Fork John Day River subbasin. Increased logging, road building, and poaching activities in the forested uplands have contributed to the declining populations. Between 1969 and 1973, biologists counted an annual average of 32 spring chinook salmon redds per mile in the system. Counts for 1981 to 1985 show spawning density decreased to an average level of 10 redds per miles. Summer steelhead production also has declined slightly. Declines in populations are primarily attributable to dam mortality.

SR steelhead, listed as threatened in 1997, and MCR steelhead, listed as threatened in 1999, have shown some recent improvement, although the data for wild fish are insufficient to draw any conclusions about trends. The recent improvement in run sizes over the last few years in encouraging. However, escapement levels are well below what is needed to fully seed rearing habitat (USDI 2001). During 1990-1995 the percentage of wild origin steelhead migrating above Lower Granite dam averaged 14% of the total run. The majority of steelhead in the SR system are of hatchery origin. Data for the past 10 years indicate that the hatchery origin steelhead continue to outnumber the wild fish in both SR and MCR ESUs.

The proposed actions discussed within this Opinion are within designated critical habitat for SR spring/summer chinook salmon. Critical habitat for SR spring/summer chinook salmon was designated on December 28, 1993, (58 FR 68543). Critical habitat for SR chinook salmon encompasses the major Columbia River tributaries known to support this ESU, including the Salmon, Grande Ronde, Imnaha, Deschutes, John Day, Klickitat, Umatilla, Walla Walla, and Yakima Rivers, as well as the Columbia River and estuary. Critical habitat consists of all waterways below long-standing (more than 100 years duration), naturally-impassable barriers, and therefore includes the project area. The riparian zone adjacent to these waterways is also considered critical habitat. This zone is defined as the area that provides the following functions: Shade, sediment, nutrient/chemical regulation, stream bank stability, and input of large woody debris/organic matter.

Essential features of the adult spawning, juvenile rearing, and adult migratory habitat for the ESUs of steelhead and chinook salmon addressed in this Opinion are: Substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, food, riparian vegetation, space, and safe passage conditions. The essential features that the project may affect are: Substrate, water quality, water temperature, water velocity, cover/shelter, food, and riparian vegetation.

2.1.2 Evaluating Proposed Action

The standards for determining jeopardy are set forth in section 7(a)(2) of the ESA as defined by 50 CFR Part 402 (the consultation regulations). NOAA Fisheries must determine whether the action is likely to jeopardize the listed species and/or whether the action is likely to destroy or adversely modify critical habitat. This analysis involves the initial steps of: (1) Defining the biological requirements and current status of the listed species; and (2) evaluating the relevance of the environmental baseline to the species'current status.

Subsequently, NOAA Fisheries evaluates whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for recovery. In making this determination, NOAA Fisheries must consider the estimated level of mortality attributable to: 1) Collective effects of the proposed or continuing action, 2) the environmental baseline, and 3) any cumulative effects. This evaluation must take into account measures for survival and recovery specific to the listed salmonid's life stages that occur beyond the action area. If NOAA Fisheries finds that the action is likely to jeopardize, NOAA Fisheries must identify reasonable and prudent alternatives for the action. Furthermore, NOAA Fisheries evaluates whether the action, directly or indirectly, is likely to destroy or adversely modify the listed species' designated critical habitat. NOAA Fisheries must determine whether habitat modifications appreciably diminish the value of critical habitat for both survival and recovery of the listed species. The NOAA Fisheries identifies those effects of the action that impair the function of any essential element of critical habitat. The NOAA Fisheries then considers whether such impairment appreciably diminishes the habitat's value for the species' survival and recovery. If NOAA Fisheries concludes that the action will destroy or adversely modify critical habitat it must identify any reasonable and prudent alternatives available.

For the proposed action, NOAA Fisheries' jeopardy analysis considers direct or indirect mortality of fish attributable to the action. NOAA Fisheries' critical habitat analysis considers the extent to which the proposed action impairs the function of essential elements necessary for juvenile and adult migration, spawning, and rearing of the SR spring/summer salmon and steelhead under the existing environmental baseline. When analyzing herbicide applications, NOAA Fisheries establishes risk to listed species by considering the toxicity of herbicides proposed for use, and examining the likelihood of exposure of listed species to those herbicides.

2.1.3 Biological Requirements

The first step in the methods the NOAA Fisheries uses for applying the ESA section 7(a)(2) to listed salmon and steelhead is to define the species' biological requirements that are most relevant to each consultation. NOAA Fisheries also considers the current status of the listed species taking into account population size, trends, distribution and genetic diversity. To assess the current status of the listed species, NOAA Fisheries starts with the determinations made in its decision to list SR salmon and steelhead and MCR steelhead for ESA protection, and also considers new data available that is relevant to the determination.

The relevant biological requirements are those necessary for SR spring/summer chinook and steelhead, and MCR steelhead to survive and recover to naturally reproducing population levels, at which time protection under the ESA would become unnecessary. Adequate population levels must safeguard the genetic diversity of the listed stock, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment. For this consultation, the biological requirements are improved habitat characteristics that function to support successful adult and juvenile migration, spawning and rearing.

2.1.4 Environmental Baseline

Environmental baseline conditions within the action area were evaluated for the subject actions at the project level and the watershed scales. The results of this evaluation, based on the "matrix of pathways and indicators" (MPI) described in *Making ESA Determinations of Effect for Individual or Grouped Actions at the Watershed Scale* (NMFS 1996) follow. This method assesses the current condition of instream, riparian, and watershed factors that collectively provide properly functioning aquatic habitat essential for the survival and recovery of the species.
The effects of proposed actions are expressed in terms of the expected effect (restore, maintain, or degrade) on aquatic habitat factors in the project area.

2.1.4.1 Lower Grande Ronde Subbasin

The Lower Grande Ronde (LGR) Subbasin is in the northeast corner of Oregon and southeast Washington and is a part of the Grande Ronde River basin. The LGR is 968,973 acres in size. Approximately 50% (483, 771 acres) of this is National Forest System land, 0.02 % (22,376 acres) is administered by the BLM, and the remaining 50 % (464, 321 acres) is private or state administered land. The subbasin contains the part of the Grande Ronde River from Rondowa, Oregon, at the confluence with the Wallowa River at river mile 82, to its' confluence with the SR. It is bordered to the west by the Umatilla River basin, to the east by the Imnaha River basin, and the north by the smaller SR tributary systems. Major tributaries to the LGR are the Wenaha River and Crooked, Grossman, Wallupa, Wildcat, Mud, Joseph, and Courtney Creeks. The topography of the basin is characterized by rugged mountains in the headwaters, giving way to plateaus dissected by precipitous canyons, and finally to the broad Grande Ronde River valley in the lower basin. Vegetation changes from forests to rangelands as the elevation drops.

Steep dissected topography is common throughout the subbasin. Tributary streams typically originate in the upper basalt plateaus and flow into steep sided canyons. Tributary streams are predominantly Rosgen A1 and A2 types with bedrock and boulder substrate. The majority of larger streams in the watershed are characterizes as Rosgen B2, with large cobble/coarse gravels, and well defined channels. In the lower reaches, valley floors widen and stream gradients lessen at their confluence with the Grande Ronde River. Alluvial fans in these areas are strewn with cobble and gravel. Because of the substantial elevation changes within the subbasin, two distinct hydrographs can be expected: snow melt hydrographs in the spring and rain event hydrographs in the late spring, summer, and early fall.

Geology of the subbasin is highly influenced by the prevalence of basalt bedrock. The basalt is generally fine-grained, hard, highly fractured, and resistant to weathering. Principal soil types are residual soils derived from the basalt bedrock and ash or mixed soils derived from volcanic ash, loess, or colluvial surface deposits. Soils are generally deeper on north and east slopes and shallower on south and west facing slopes. North and east slopes also have a greater proportion of ash or mixed soils.

Natural disturbances that have occurred in the subbasin include localized flash flooding in tributaries, windstorms, insect epidemics, and wildfires. In February of 1996 and again in January of 1997, flash flooding resulted from rain on snow events as well as rain falling on super-saturated soils. The 1997 flood in particular caused mass movement of soil stream bedload materials. The floods were of such magnitude that seral development of the riparian areas and channel development in tributaries was stalled. Since 1960, numerous wildfires have occurred in the LGR Subbasin resulting from lightening strikes or human activities. The largest fires in the subbasin was in the Joseph Creek Watershed.

Agricultural use and livestock grazing are prevalent along the lower reaches of the LGR river. Dry land and irrigated farming practices occur within available riparian areas. Twelve grazing leases authorized by the BLM are within the subbasin. Oregon Department of Fish and Wildlife (ODFW) authorizes grazing on upland bench pastures of the Wenaha Wildlife Area and the Washington Department of Game authorizes grazing on the Joseph Creek Wildlife Area. A significant amount of livestock production occurs on private land; cows winter along the river, graze the grassy slopes in the spring, and are moved to forested lands in the summer and fall. There has been no timber harvest on BLM land near the river. The U.S. Forest Service (USFS) reports timber harvest and associated facilities including roads, within the watershed. Recreation use is prevalent in roaded areas.

Information provided by the BLM and FS indicates that the following habitat indicators are currently rated as “functioning at risk:” stream temperature, sediment, substrate/embeddedness, pool frequency, pool quality, changes in peak/base flows, drainage network increase, road density and location, disturbance history, riparian reserves, and disturbance regimes. The following habitat indicators are “properly functioning:” chemical contaminants and nutrients, physical barriers, large woody material, refugia, off channel habitat, width to depth ratio, streambank condition, and floodplain connectivity.

Mud Creek Watershed
All of the matrix indicators are rated as "functioning appropriately" with the exception of: temperature, off-channel habitat, road density, disturbance history, riparian habitat conservation areas, disturbance regime. These indicators are "not properly functioning."

Grouse Creek Watershed
The following indicators are currently "not properly functioning:" large woody material, pool frequency and quality, refugia, width/depth ratio, streambank condition, floodplain connectivity, disturbance history, and riparian habitat conservation areas. The remaining indicators are "properly functioning."

Mainstem Grande Ronde-Rondowa
Currently, temperature, chemical contaminants, refugia, streambank condition, peak/base flows, road density, disturbance history, riparian habitat conservation areas, and disturbance regimes are all "not properly functioning." Pool frequency and quality are "not properly functioning" levels. Width/depth ratio and substrate/embeddedness were not rated due to a lack of sufficient information.

2.1.4.2 Upper Grande Ronde Subbasin

Broad rolling uplands to the north and complex mountains and dissected volcanic plateaus to the south characterize this subbasin. The drainage pattern is strongly influenced by northwest trending faults and a northeast trending fold system. There are a variety of rock types in the subbasin, each with different weathering and erosion characteristics. The dominant rock type is Columbia River Basalt. These basalts were formed by high volume fissure eruptions of the Columbia Plateau, a flat features geologic province that existed before the uplift of the Blue Mountains. Most of the soils in the subbasin are relatively stable. Mass movement that does occur is in the form of debris slides, rockfall, slumps, and soil creep. Landslides are rare in the subbasin except in the few areas where basalt lying of tuffaceous sediments has become unstable.

Most of the major streams in the subbasin have variable gradients. Gradients in downstream reaches average between one and four percent while gradients in the upper headwater reaches average between four and twelve percent. The majority of streams can be categorized as Rosgen B2 type streams. These streams have moderate gradients, large cobble, coarse gravel substrates, and well defined channels.

Information provided by the BLM and FS indicates that the following habitat indicators are currently rated as "functioning at risk:" stream temperature, sediment, substrate/embeddedness, physical barriers, large woody material, pool frequency, pool quality, off channel habitat, refugia, width to depth ratio, streambank condition, road density and location, and disturbance regimes. Changes in peak/base flows and drainage network indicators are "not functioning properly." The remaining habitat indicators are "properly functioning:" Chemical contaminants and nutrients, riparian reserves, and floodplain connectivity. Specific information about watersheds in this subbasin was not available.

2.1.4.3 Wallowa Subbasin

Located in the Grande Ronde River Basin of northeast Oregon, this perennial drainage originates from a group of alpine lakes in the Eagle Cap Wilderness of the Wallowa Mountains. The subbasin consists of nearly 400,000 acres; less than 1% (about 3,900 acres) is manage by the BLM, about 26% is under USFS Management, and the remainder is privately owned. The portion of the Wallowa River from Minam downstream to Rondowa is managed under the guidelines established by the cooperative agreement between the BLM, USFS, Oregon State Parks and Recreation Department, and the Washington State Shoreline Program (Asotin County). The guidelines provide protection and enhancement of the identified Outstandingly Remarkable Values including the scenic recreation, fisheries, wildlife, and other high quality values.

This subbasin is part of the Blue Mountain province. Narrow steep sided canyons, eroded uplands, and intermontane valleys characterize the landscape. Soils in the area are highly variable ranging from residual soils derived from granitic and basalt bedrock to ash soils. Physical characteristics of the soil profiles are extremely variable and are dependent upon parent material, elevation, slope, aspect, and climatic conditions. The river corridors running through the subbasin are diverse systems. Plant species commonly found along streambanks include willows, rose, and snow berry. Vegetation in upland portions of the subbasin varies according to elevation. At elevations greater then 4,000 feet mixed coniferous forests of ponderosa pine, Douglas fir, and grand fir predominate. Bluebunch wheatgrass and Idaho fescue are common at low elevations on cooler, damp, northern slopes. Warmer, drier slopes are dominated by sandberg bluegrass as well as Bluebunch wheatgrass.

Information provided by the BLM and FS indicates that the following habitat indicators are currently rated as "properly functioning:" Water quality, chemical contaminants and nutrients, physical barriers, substrate/embeddedness, large woody material, stream bank condition, change in peak/base flow, and refugia. The following four matrix indicators were rated as "not properly functioning:" Large pools, pool frequency, width to depth ratio, road density and location. Sediment, off channel habitat, drainage network increase, disturbance reserves, and riparian reserves are all "functioning appropriately." Specific information about watersheds in this subbasin was not available.

2.1.4.4 North Fork John Day River Subbasin

The North Fork John Day River (NFJDR) subbasin is part of the John Day River (JDR) Basin and is in northeastern Oregon. The John Day River is a major tributary of the Columbia River. The JDR is the longest free-flowing river with wild anadromous salmon stocks in the Columbia River Basin. The JDR basin includes 11 counties and is bounded by the Columbia River to the north, the Blue Mountains to the east, the Aldrich Mountains and Strawberry Range to the south, and the Ochoco Mountains to the west. The main stem JDR flows from the Strawberry Mountains to its mouth at River Mile (RM) 218 on the Columbia River. Major tributaries include the North Fork and South Fork.

The NFJDR contributes over 60% average annual discharge of the John Day River Basin (Oregon 1990). The NFJDR forms in the crest of the Blue Mountains about 10 miles northeast of the town of Granite, Oregon. The river flows westward for over 100 miles and empties into the JDR near the town of Kimberly, Oregon (RM 184.2 of the main stem JDR). The subbasin elevation ranges from 1,830 feet near the mouth to over 8,300 feet in the headwaters. The NFJDR subbasin is in Baker, Grant, Morrow, Umatilla, Union, and Wheeler Counties, Oregon. Incorporated cities within the subbasin are Monument, Ukiah, and Granite.

Over 33% of the NFJDR subbasin is privately owned. Federal ownership amounts to approximately 63%, including lands managed by the USFS (60%) and USDI BLM (3%). The rest of the land ownership is accounted for by the State of Oregon (2%) and other (2%). Forested land comprises 77% of the subbasin, range land and pasture another 20% and the remainder is crops and irrigated agriculture. Streams in the NFJDR subbasin provide spawning, rearing, and migratory habitat for MCR steelhead.

Information provided by the USFS and BLM (USDA and USDI 1999) indicates that in the NFJDR subbasin, 5 habitat indicators in the MPI were rated as “properly functioning” and include: Chemical contaminants/nutrients, physical barriers, large pools, off-channel habitat, and disturbance history. Eleven were rated as “functioning at risk” and include: Sediment, substrate, large woody debris (LWD), pool frequency and quality, refugia, wetted width/maximum depth ratio, streambank condition, floodplain connectivity, change in peak/base flows, drainage network increase, and riparian reserves. Two indicators, temperature and road density/location, were rated as “not properly functioning.”

Some habitat indicators that were rated as “properly functioning”for the subbasin as a whole, such as chemical contaminant/nutrients, may be functioning at a lesser condition in localized areas. For instance, in areas of concentrated mining activities, chemical contaminants such as heavy metals may be present. In addition, a chemical spill in the NFJDR in 1990 result in fish kills and reduced densities of aquatic invertebrates. In a similar circumstance, recent wildfires have led to localized increase in peak/base flows and degraded riparian areas by burning hardwood shrubs and other hydrophilic vegetation.

<u>Cable Creek Watershed</u>
In the Cable Creek watershed, temperature was the only habitat indicator that was rated as “not properly functioning.” Five of the habitat indicators were rated as “functioning at risk” and include: Substrate, pool frequency and quality, change in peak/base flow, road density and location, and RHCAs. Nine habitat indicators were rated as “properly functioning” and include: Chemical contaminants/nutrients, physical barriers, LWD, large pools, off-channel habitat, width/depth ratio, streambank condition, drainage network increase, and disturbance history.

Sediment, refugia, floodplain connectivity were not rated by the UNF due to a lack of adequate information.

2.1.4.5 Walla Walla River Subbasin

The Walla Walla Rivers subbasin is in northeastern Oregon and southeastern Washington. The Walla Walla River drains approximately 1,760 square miles and is a tributary of the Columiba River. This subbasin is comprised of three major river systems, The Walla Walla River, Touchet River, and Mill Creek. Most of the headwater areas of the Walla Walla subbasin are under public ownership and are managed by the USFS.

Elevations of the subbasin range from approximately 6,250 feet at the headwaters of the Walla Walla River, to 340 feet at the confluence with the Columbia River. Much of the northern and western portions of the subbasin are characterized by rolling treeless uplands formed by deep deposits of loess underlying multiple layers of Columbia River flood basalts. The dominant land use type in this area is dryland wheat farming. River lowlands within this area, especially near the towns of Walla Walla, Washington and Milton-Freewater, Oregon are relatively flat with sandy loam soils that in many areas contain a considerable amount of rounded cobbles. The dominant land use in these areas are irrigated crops, orchards, and urban development. The eastern and southern portions of the subbasin contain the northern most extension of the Blue Mountains. Land use practices here are dominated by forestry and grazing with a considerable amount of land in an unmanaged state. Streams in the Walla Walla subbasin provide spawning, rearing, and migratory habitat for MCR steelhead.

Information provided by the USFS (USDA 1999) indicates that in the Walla Walla subbasin one habitat indicator in the MPI, disturbance history was rated as “properly functioning.” Ten habitat indicators were rated as “functioning at risk” and include: Temperature, physical barriers, large woody debris, pool frequency/quality, refugia, width/depth ratio, floodplain connectivity, drainage network increase, road density/location, and riparian reserves. Four indicators were rated as “not properly functioning” and include: Chemical contaminants/nutrients, substrate, off-channel habitat, and change in peak/base flow. Sediment/ turbidity and streambank condition were not rated due to a lack of information.

<u>South Fork Walla Walla Watershed</u>
The South Fork of the Walla Wall River originates at Deduct Springs at approximately at an elevation of 5,400 feet. From its origin it flows south and then west for approximately 14 miles through a deep canyon before entering the Umatilla National Forest near the mouth of Bear Creek. Throughout most of this area the river is in the Walla Walla River roadless area and is paralleled by a trail used by motorized and non-motorized recreationists. After reaching the Umatilla National Forest boundary, the river flows across about a half mile of private land where serval cabins are located. From here the river flows through land managed by the BLM for about four miles. Many springs along this part of the river add to its flow and help it maintain cool temperatures. The river is primarily Rosgen B and A channel types in this section. This stretch of the river provides spawning and rearing habitat for MCR steelhead.

Information provided by the USFS (USDA 1999) indicates that ten habitat indicators were rated as “properly functioning” and include: Temperature, Chemical contaminants/ nutrients, physical barriers, large woody debris, refugia, floodplain connectivity, increase in drainage network, road density and location, disturbance history, and riparian reserves. Four habitat indicators were rated as “functioning at risk” and include: substrate, poll frequency/ quality, off-channel habitat, and width to depth ratios. No indicators were rated as “not properly functioning.” Sediment/ turbidity and streambank condition were not rated due to a lack of information.

2.1.5 Effects of the Proposed Action

The effects determination in this Opinion was made using a method for evaluating current aquatic conditions, the environmental baseline, and predicting effects of actions on them. The effects of the action are expressed in terms of the expects effect (restore, maintain, or degrade) on aquatic habitat factors in the action area. For the proposed actions, SR steelhead, MCR steelhead, SR fall chinook salmon, and SR spring/summer chinook salmon habitat indicators for the action area will either be improved or maintained in the long term.

Effects of the proposed project to stream habitat and fish populations can be separated into direct and indirect effects. Direct effects are those that contribute to the immediate loss or harm to individual fish or embryos (*e.g.* heavy equipment directly crushing a fish, crushing or destabilizing a redd that results in the actual destruction of embryos, dislodging the embryos from the protective nest and ultimately destroying eggs). Indirect effects are those effects which occur at a later time, causing specific habitat features (*e.g.* undercut banks, sedimentation of spawning beds, loss of pools), localized reductions in habitat quality (*e.g.* sedimentation, loss of riparian vegetation, changes in channel stability and structure), and which ultimately cause loss or reduction of populations of fish, or reductions in habitat quantity and/or quality.

The application of herbicides in proximity to lakes and river systems can result in the transport of potentially toxic chemicals (active ingredients and/or adjuvants) to surface waters (USGS, 1999). Such actions constitute a chemical modification of salmon habitat, and they have the potential to harm threatened or endangered species. Similar to physical forms of habitat modification (*i.e.* activities that increase sedimentation, increase water temperatures, or reduce the volume of water in streams), chemical habitat modification can adversely affect salmon via pathways that are both indirect and direct. In terms of indirect effects, herbicides can impair the essential biological requirements of salmon if they undermine the physical, chemical, or biological processes that collectively support a productive aquatic ecosystem (Preston, 2002). The direct effects of herbicides are a concern if they significantly impair the physiological or behavioral performance of salmonids in ways that will reduce growth and survival, migratory success, or reproduction.

To evaluate the risk of harm, affects analyses should proceed according to the following logical sequence:

- Expected environmental concentrations and persistence
- Evidence that the herbicide will enter salmon habitat
- Evidence for impacts to the aquatic food chain (indirect effects)
- Evidence for impacts on salmon health (direct effects)

This analysis of effects will follow the above sequence, beginning with a discussion of what is known about dicamba, 2,4-d, picloram, glyphosate, and adjuvants used with these herbicides.

2.1.5.1 Adjuvants

An adjuvant is a substance used in a pesticide to enhance performance. It may be added at the time of formulation or just before treatment. Adjuvants may affect performance of the pesticide, especially herbicides, and pesticide labels will specify if surfactants are required and the amount of active ingredient it must contain (Tredway 2000).

Adjuvants include the following:

1. <u>Surfactants (surface-active ingredients)</u>. These are substances that improve the emulsifying, dispersing, spreading wetting, or other surface-modifying properties of liquids. Surfactants include emulsifying agents, crop oils, concentrates, and stickers.

2. <u>Emulsifying Agents</u>. An emulsion is a mixture of two incompletely mixed liquids, one which is dispersed in the other. Emulsifying agents work to promote the suspension of one liquid in the other. In herbicides, there are two types of emulsions: "Oil-in-water" emulsion, in which the spray mixture in similar to water, and "water-in-oil" emulsion, a rather viscous spray, also called "invert" emulsions. The "oil-in-water" emulsions are widely used in the formulation of herbicides to aid in getting an oil-soluble herbicide dispersed in a water mixture so that the active ingredient may be applied as a water spray. Inert emulsions are used to aid in drift control, to improve resistance of the herbicide treatment to the effects of weather (rain), to improve accuracy of delivery of the herbicide, and to enhance herbicide activity.

3. <u>Wetting Agents (spreaders)</u>. Spreaders are added to decrease surface tension in a mixture and cause a larger portion of each spray droplet to come in contact with surface of the vegetation. The goal is to increase coverage and effectiveness, although it may also alter herbicide selectivity. There are four spreader types: (1) Anionic, which has an electrical charge in water; (2) Cationic, which has an electrical charge in water; (3) Nonionic, which does not have an overall electrical charge; and (4) Amphoteric, which has positive or negative charges, depending on the pH of the solution. The type of spreader, if any, prescribed by the herbicide label should be selected. Some herbicides are especially sensitive to pH, particularly in the degradation process (Tredway 2000).

4. Drift Control Agents. Drift of herbicide sprays can be a problem in some environments. One way to reduce herbicide drift is to increase the droplet size of the spray. Adjuvants that are used to control drift do so, in part, by reducing the number of fine spray droplets. Thickeners may be used as drift control agents.

5. Crop Oil Concentrates. Products that contain 80-85% petroleum or vegetable oil and 14-20% surfactant and emulsifiers. An “emulsifiable oil”, on the other hand, is a product that contains 98% oil and 1-2% emulsifiers. This group is also called “nonphytotoxic oils” and “phytobland oils.”

6. Stickers. Adjuvants that cause herbicide to stick to foliage and prevent runoff from target vegetation. The desired result is increased effectiveness.

7. Compatibility Agents. Adjuvants that aid in the suspension of herbicides when they are combined with other pesticides or fertilizers. Used primarily when the carrier solution is a liquid fertilizer.

8. Acidifiers and Buffers. Acidifiers are acids that neutralize alkaline solutions and lower pH when added to herbicide, while buffers can change the pH to a certain level and maintain it, even if the alkalinity changes.

9. Antifoaming Agents and Spray Colorants. Defoaming agents and dyes (Treadway 2000).

2.1.5.2 Dicamba

Dicamba is a 3,6-dichloro-2-methoxybenzoic acid, commonly known as Banvel®, Banex®, Trooper®, or it may be sold under a number of other brand names. It is a member of the benzoic acid chemical family. Benzoic acid herbicides are similar in mode of action and structure to the phenoxy herbicides, such as 2,4-D. Like phenoxy herbicides, dicamba mimics a plant growth hormone, affecting cell division (Cox 1994). Dicamba is registered by the EPA as a General Use Pesticide (GUP), and can be applied as a pre- and post-emergent herbicide to leaves or soil for annual or perennial broadleaf control in grain crops and grasslands. It may also be used for brush, vine and bracken control on pastureland. The registered use rate is 0.25 to 8.0 pounds (lb) per acre, and the method of application is ground or aerial broadcast, band treatment, basal bark treatment, cut surface treatment, spot treatment, or wiper. Dicamba is absorbed by leaves and roots moving through the plant. Accumulation may occur in leaf tips. (Extonet website at: http://ace.orst.edu/cgi-bin/mfs/01/pips, USDA 2001).

Commercially-produced dicamba contains one or more inert ingredients. The percentage and type depends on the company creating the product. Dimethylamine salt of dicamba makes up 48.2% of the product, dimethylamine salts of related acids make up 12 % of the product, and the remaining 39.8% are classified as “Trade Secrets or Non-Hazardous” on the Material Safety Data Sheet (MSDS) for one dicamba product (http://www.horizononline.com/MSDS_Sheets/48.txt.)

Dicamba is categorized by the EPA as "slightly toxic" to fish, and "practically non-toxic to aquatic organisms. The LC50 (96-hour) for technical dicamba is 135 milligrams per liter (mg/l) in rainbow trout (*O. mykiss*) and bluegill sunfish (*Lepomis microchirus*). The LC50 (48-hour) for dicamba is 35 mg/l in rainbow trout (USDA 2001, Extonet website). It is important to note that although dicamba is "slightly toxic" to fish, there are variations in study results with reference to salmonids. One study found that there were no effects on yearling coho salmon (*O. kisutch*) at concentrations up to 100 parts per million (ppm). However, yearling coho were killed by much smaller doses (0.25 ppm) during a seawater challenge test that simulated their migration from river to ocean (Cox 1994). Little is known about sublethal effects on fish.

Dicamba does not bind to soil particles. Microbes appear to be the primary source of chemical breakdown the soil. In sterilized soil, over 90% of applied dicamba was recovered after four weeks, suggesting that microbes were responsible for the decomposition (toxnetHSDB website). Sunlight does not appear to play a major role in breakdown, as with many other herbicides. Volatilization[3] of dicamba from soil surfaces may not be an important process, although some volatilization can occur from plant surfaces. The principal soil metabolite appears to be 3,6-dichlorosalicylic acid (Extonet website).

Another study evaluated the relationships between microbial biomass and how the herbicides dicamba and 2,4-D (acid form) degrade. The hypothesis was that size of microbial biomass would be a strong predictor of pesticide degradation capacity. Herbicides were applied to similar soils collected from five different land use types (home lawn, cornfield, upland hardwood forest, wetland forest, and aquifer material). Herbicide residue, microbial biomass indicators carbon and nitrogen, and organic material amount were all positively correlated with the dissipation of dicamba and 2,4-D (Voos 1995).

The half-life of dicamba in soil has been observed to vary from four to 555 days, with the typical half-life being one to four weeks (Weed Sci Soc Amer 1983), classifying dicamba as "moderately persistent" in soil. However, the rate of biodegredation declines when soil moisture is above 50%, or the soil is sterile. In humid areas, leaching of dicamba out of the soil takes three to 12 weeks. (toxnet HSDB website at: http://toxnet.nlm.nih.gov).

Dicamba is highly soluble in water and therefore highly mobile in the soil. It was found that absorption is strongest in soils with lower PH levels (4.0 - 6.0) (Kearney *et al.* 1975).

Evaluation of soil persistence in different soil types was undertaken by Smith (1984), who studied under laboratory conditions (14)C-dicamba at an application rate of one kilogram per hectare (kg/ha) on clay loam, a heavy clay loam, and a sandy loam at 85% field capacity, at 20 degrees Fahrenheit. The times for 50% of the applied dicamba to be degraded were approximately 16 days in both the clay loam and sandy loam, and about 50 days in the heavy clay.

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[3]Vaporization.

Donald (2001) studied various pesticide residues in prairie wetland areas. The wetland sites were on or near pesticide use areas, with control sites for comparison. The authors found similar detection frequencies and concentrations of dicamba and 2,4-D in all sampling sites, concluding that atmospheric transport via volatilization and/or evapotranspiration with rainfall redistribution were mechanisms responsible for the occurrence of herbicide residues in pristine wetlands .

In water, microbial degradation appears to be the most important dicamba removal process. Scifres *et. al* (1973) found that in nonsterile water, 16% of applied dicamba disappeared after 133 days while only 5% disappeared in sterile water, thereby suggesting the importance of microbial decomposition in water. Photolysis[4] may contribute to its removal from water while aquatic hydrolysis, volatilization, adsorption[5] to sediment, and bioconcentration are not expected to be significant (toxnet HSDB website).

In their Pesticide Fact Sheet (USDA 2001), the USFS recommends special precautions for application of dicamba. Dicamba should generally be applied during active plant growth periods, with spot and basal bark periodic application during dormancy. However, no application should be conducted if snow or water prevent application directly to the ground. Drift control is recommended as well. Precautions should be taken not to apply dicamba where it may move down into the soil or be washed along the soil surface towards desirable plants (*e.g.* riparian vegetation). Application should not occur when air currents would carry spray towards desirable plants. Buffer zones should be left between the area to be treated and any desirable plants. Applications should not occur near desirable plants on days when temperatures may exceed 85 degrees F. Aerial applications should be avoided when desirable plants are growing near the areas to be treated. Fine sprays should be avoided. The USFS warns that dicamba must be kept out of lakes, streams, ponds, irrigation ditches, and domestic water sources (USDA 2001).

Dicamba can be combined with a phenoxyalkanoic acid such as 2,4-D (Weed Master) or a glyphosphate (Fallow Master) for weed control on rangeland and non-agricultural land, such as fence-rows and roadways. These “two-way” herbicides remain highly soluble and subject to drift.

The toxicity to fish of dicamba-containing herbicides may be increased by the products used with them. In 1992, the deaths of 40 fish in Douglas County, Oregon, were linked to Weedmaster, an herbicide containing dicamba and 2,4-D.

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[4]Chemical decomposition by the action of radiant energy.

[5]To take up and hold (liquid or gas) on the surface of a solid. Compare to the general term “absorption:” to take something in through or as through pores or interstices.

2.1.5.3 2,4-D

2,4-D is 2,4-Dichlorophenoxyacetic acid, commonly known as Solution®, Savage®, DPD Ester Brush Killer®, Barrage®, or a number of other products. 2,4-D is registered by the EPA as a GUP in the U.S., and is used to control many types of broadleaf weeds. 2,4-D is toxic to most broadleaf crops, especially cotton, tomatoes, beets, and fruit trees. The registered use rate is 0.475 to 3.8 (lbs) active ingredient per acre, and the method of application may be aerial and ground spraying, lawn spreaders, cut surface treatments, foliar spray, basal bark spray, or injection (Extoxnet website, USDA 2001).

2,4-D is a member of the chlorinated phenoxy family and interferes with normal plant growth processes by stimulating nucleic acid, protein synthesis and affecting enzyme activity, respiration, and cell division. Uptake of the compound occurs through leaves, stems, and roots (USDA 2001).

There are many forms or derivatives of 2,4-D. Herbicides containing 2,4-D use the amine salt or ester forms of the compound. The amine and ester forms may differ in health-related activity and environmental fate and effects from the parent 2,4-D acid. Unless otherwise noted below, "2,4-D" refers collectively to the acid, amine salt, and ester forms.

Commercially produced 2,4-D contains one or more inert ingredients. The percentage and type depends upon the company creating the product, and whether the compound is an amine salt, ester, or the pure parent acid form (latter rarely used). For example, HiDepr (liquid)® contains dimethylamine salt of 2,4-D (33.2%) and diethanol-amine salt of 2,4-D (16.3%), with ethylene glycol (10%) and other inerts (40.3%).

Depending upon the formulation used, the aquatic ecotoxicity rating can range from "Very Highly Toxic" to "Practically Nontoxic" to aquatic organisms (2,4-D Pesticide fact sheet at: http://infoventures.com). For cutthroat trout (*Salmo clarki*), LC50s range between 1.0 and 100 mg/l. The Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Vertebrates (1980) reports a LC50 of 64 mg/l for 96 hours for cutthroat trout (95% confidence limit 57-72 mg/l) using 2,4-D acid, granular 100%/ wt 0.3 grams and pH at 7.2-7.5. Channel catfish (*Ictalurus punctatus*) had less than 10% mortality when exposed to 10 mg/l for 48 hours. Green sunfish *(Lepomis cyanellus*), when exposed to 110 mg/l for 41 hours, showed no effect on swimming response. Limited studies indicate a half-life of less than two days in fish and oysters (Extoxnet website).

Examining differences in toxic effects to aquatic organisms, 2,4-D amine salt forms are generally non-toxic to fish. However, studies have also shown that toxicities of two amine salts to fathead minnows (*Pimephales promelas*) did not change after aging test solutions 21 days. Also, fry and fingerlings are considerably more sensitive than eggs to two amine salts of 2,4-D. In fathead minnows, tests with the dimethyl amine of 2,4-D yielded 96-hour LC50s ranging from 320-6300 mg/l for fingerlings and swim-up fry, compared with over 1,400 mg/l for the egg stage, and in rainbow trout, tests with dodecyl/tetradodecyl amine against several life stages yielded LC50s (mg/l) of 3.2 for fingerlings, 1.4 for swim-up fry, 7.7 for yolk-sac fry, and 47 for eggs (USFWS 1980). Sublethal effects for the amine salt form include the reduction in the ability of rainbow trout to capture food at five ppm. Research has shown bioconcentration in fish tissue (Cox 1999).

The 2,4-D compound that is most toxic to fish, particularly juvenile salmonids, is the butoxyethanol ester formulation. Acute LC50s for this particular formulation have been found for chinook salmon fry and smolts of < 0.4 ppm, for juvenile chum salmon (*O. keta*) < 0.8 ppm, and for juvenile pink salmon (*O. gorbuscha*) <1.0 ppm. Sublethal effects on the growth of juvenile chinook salmon have been investigated. Growth was reduced by using 0.6 ppm of the butoxyethanol ester formulation. Using the same formulation, physiological stress responses in sockeye salmon occurred at 0.3 ppm. Research has shown bioconcentration in fish tissue (toxnet HSDB website).

2,4-D acid in its pure form at 100 ppm caused slight mortality in fingerling bream and largemouth bass (toxnet HSDB website). The 96-hour LC50 is reported for the granular form of 2,4-D, acid, for lake trout (*Salvelinus namaycush*) as being 45 mg/l (95% confidence limit 35-56 mg/l), 100%/ wt 0.3 g, pH 7.2-7.5 (USFWS 1980). The 48-hour LC50 for rainbow trout is reported at 1.1 mg/l. Research has shown bioconcentration in fish tissue (Walters 1999).

Sublethal effects for the amine salt form include the reduction in the ability of rainbow trout to capture food at five mg/l (Cox 1999). Sublethal effects studies showed that on the growth of juvenile chinook salmon was reduced with a concentration of 0.6 ppm of the butoxyethanol ester formulation. Using the same formulation, physiological stress responses in sockeye salmon (*O. nerka*) occurred at 0.3 ppm (HSDB website: http://toxnet.nlm.nih.gov). One experimental model studied acute lesions in the area kidney that produces red blood cells in tench (*Tinca tinca*) caused by continuous exposure to 2,4-D acid dissolved in water at 400 mg/l. Fifty fish were used, 15 for calculating the LC50 and 35 were euthanized in five treated and two control groups. Tissue samples revealed marked alteration of red blood cells, characterized by progressive swelling and tissue death, and activation of white blood cells. The lethal dose (LC50) at 96 hours demonstrated the importance of the species and chemical form used as factors in calculating a product's toxicity (Gomez 1998)

A relationship exists between toxicity and pH level in a waterbody. In one study, the percent of fathead minnows surviving a particular concentration of 2,4-D increased as the pH increased in the water. At a concentration of 7.43 mg/l, 60% of the fish survived in 192 hours at pH 7.6, whereas 100% survived at pH 9.8. At the former concentration, normal schooling behavior was completely disrupted and equilibrium lost after 24 hour exposure. At the latter concentration, neither effect was noted, with pH measured at 8.68 and 9.08. A relationship between pH and the degradation of 2,4-D is present in soil medium, as well (toxnet HSDB website).

It should be noted that degradation of 2,4-D with varying pH levels varies between forms of 2,4-D. Research has shown the dodecyl/tetradodecyl amine form to be nearly four times more toxic to fathead minnows at certain aquatic pH levels (8.5), while the acid form, a butyl ester form, and a dimethyl ester form were about half as toxic to fish at this pH level (USFWS 1980).

The fate of 2,4-D may also be affected by several processes including runoff, adsorption, chemical and microbial degradation, photodecomposition, and leaching. In general, 2,4-D has a moderate persistence in soil with a field dissipation half-life of 59.3 days, aerobic half-life of 66 days, and a hydrolysis half-life of 39 days. For some chemicals, such as 2,4-D, the influence of soil pH is mainly responsible for transformation from anionic[6] to nonionic[7] forms with decreasing pH. This can, in turn, affect adsorption. At less than a pH level of 6.0, 2,4-D is in nonionic form. Increasing the pH above 6.0 turns 2,4-D anionic. In slightly acidic soils, 2,4-D will be adsorbed at a pH level of less than 6.0 but will not be readily adsorbed at a pH level of 7.0 if in the anionic form, because the negative charges of the soil and of the chemical, repel each other (Welp, 1999; Walters, 1999).

Overall, the persistence of 2,4-D depends upon formulation, pH, soil moisture, soil type, temperature, microbes, and the status of pre-exposure to 2,4-D or its salts or esters (which alters concentrations of 2,4-D applications in the soil). Once in soil, 2,4-D esters and salts are first converted to the parent acid before degradation (Walters 1999).

The rate of microbial degradation is dependent upon the water potential, depth and temperature of the soil. Han and New (1994) found that sandy loam soil containing 2,4-D degrading single-celled bacteria, filamentous bacteria (actinomycetes), and fungi had the lowest degradation rates at a low water potential, and an increase in water potential resulted in increased rates of breakdown. Dry soil conditions inhibit 2,4-D mineralization by restricting mobility, reducing the degrading activity of organisms, and suppressing the 2,4-D degrading microorganism populations. The rate of microbial degradation decreases with increased soil depths and lower temperatures (Walters 1999).

In coarse-grained, sandy soils where both biodegradation and adsorption will be low, or with very basic soils, leaching to groundwater may occur (toxnet HSDB website). Because of the different formulations, 2,4-D ranges from being mobile to highly mobile in sand, silt, loam, clay loam, and sandy loam. Grover (1977) found that higher volumes of water were required to leach 2,4-D from soils with a high organic content. Leaching was correlated with the pH of soils, with 2,4-D leaching more readily in soils with pH's of 7.5 and above reflecting higher adsorption to organic matter in more acidic soils. The soil pH range in the proposed action area is not known.

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[6]Negatively charged ion.

[7]No charge on the ion.

Despite its potential mobility, 2,4-D generally persists within the top few inches of the soil. Walters (1999) applied 2,4-D at the rate of 4.49 kg/ha in the ester form to nursery plots with varying crop covers. The 2,4-D remained in the top 20 centimeters of the soil.

Timing and intensity of rainfall are important factors in determining the movement and extent of 2,4-D leaching in soil. It was found that 2,4-D is susceptible to runoff if rain events occur shortly after application, with runoff concentrations decreasing over time (Walters 1999). Also, the amount of litter and debris on the soil surface will provide infiltration, as 2,4-D adsorbs to the surfaces of a litter and humus layer.

Norris (1981) states that entry into waterbodies via leaching is not a significant transport method for significant quantities of 2,4-D, since most of it is adsorbed onto organic material and later readily degraded by microbial organisms. Despite assurances such as these, 2,4-D has been detected in groundwater supplies in at least five U.S. states and Canada, and very low concentrations have been detected in surface waters throughout the United States (Extoxnet website).

Persistence of 2,4-D in water is dependent upon the formulation, volatilization, level of nutrients present, pH level, temperature, oxygen content, and whether or not the water has been previously contaminated with 2,4-D or other phenoxyacetic acids. Microbial degradation is a possible route for the breakdown of 2,4-D, but it is very dependent on the characteristics of the water. In the lab, studies have shown that in warm, nutrient-rich water that has been previously treated with 2,4-D microbial degradation can be a major factor for dissipation. In cooler water, conditions may not promote the growth of microorganisms needed to achieve microbial degradation (Walters 1999). Microbial activity will play a important role in waters with bottom mud sediments and sludge. Degradation increases with sediment load (Extoxnet website, toxnet HSDB website).

2,4-D should not be applied directly to water or wetlands, such as swamps, bogs, marshes, and potholes, and the issue of contamination by drift into such areas should be addressed (USDA 2001).

2,4-D can combine with other pesticides and have a synergistic effect, resulting in increased toxicity. Combining 2,4-D with picloram damages the cells of catfish (*Ictalurus spp*) gills, although neither individual pesticide has been found to cause this damage. Application of the insecticide carbaryl in the same area as 2,4-D ester can result in rainbow trout mortality, as carbaryl increases uptake of 2,4-D (Cox 1999).

2.1.5.4 Picloram

Picloram is 4-Amino-3,5,6-trichloro-2-pyridinecarboxylic acid, also known as Access®, Grazon®, Pathway®, or Tordon®. It is registered by the EPA as a “Restricted Use” pesticide. Sale and use of these pesticides are limited to licensed pesticide applicators or their employees, only for uses covered by certification. Picloram was placed in this category due to its mobility in water, combined with the extreme sensitivity of many important crop plants to damage (USDA 2001).

Picloram is registered for control of woody plants and a wide range of broad-leaved weeds. Most grasses are resistant to picloram, so it can be used in range management programs to control bitterweed, knapweed, leafy spurge, locoweed, larkspur, mesquite, prickly pear, and snakeweed on rangeland in the western states. Picloram is formulated either as an acid (technical product), a potassium salt, a triisopropanolamine (TIPA) salt, or an isooctyl ester, and is available as either soluble concentrates, pellets, or granular formulations (Spectrum chemical fact sheet at: http://www.speclab.com/; Extoxnet website). The registered use rate depends upon the plant(s) and formulation: (1) Picloram, TIPA salt: 0.27 to 2.16 pounds acid equivalent (ae) per acre (lb ae/A); (2) Picloram, isooctyl ester: used for basal bark treatment only; and (3) Picloram, potassium salt: 1.0 to 8.5 lb ae/A.

Picloram is a pyridine carboxylic acid herbicide. Other herbicides in this class include clopyralid, quinclorac and thiazopyrs. It is absorbed by the plant roots, leaves and barks. It moves both up and down within the plant, and accumulates in new growth, interfering with the plant's ability to make proteins and nucleic acids (USDA 2001).

Both Grazon® PC and Tordon® K contain essentially the same amount of picloram (potassium salt) at 24.4%. “Inert ingredients”, which include water and dispersing agents, including surfactants, at 75.6% (USDA 2001).

The parent acid is characterized as moderately toxic to freshwater fish, with a LC50 of 5.5 mg/l (ppm) and slightly toxic to freshwater invertebrates (LC50 of 34.4 mg/l). The parent material has been tested on rainbow trout in various life stages, yielding a 96-hour LC50 of 8.0 mg/l for the yolk sac stage, 8.0 mg/l for the swim-up stage, and 11.0 mg/l for the fingerling stage (Extoxnet website; USGS acute toxicity database website). Field runoff studies conducted with cutthroat trout conclude that concentrations as low as 290 micrograms (µg/l) and 610 µg/l of the parent acid will affect survival & growth of cutthroat trout. Examining the toxicity of the individual picloram formulations, the EPA characterizes picloram TIPA salt as slightly toxic to freshwater fish, with a LC50 of 25 mg/l (ppm). A test with coho salmon yielded a LC50 of 20 ppm (USEPA 1995). The reported 96-hour LC50 for the isooctyl ester in rainbow trout is four mg/l, and in channel catfish is 1.4 mg/l, giving it a “moderate toxicity” rating. Other LC50 values in aquatic invertebrates ranged from 10 to 68 mg/l (Extonet website). The picloram potassium salt is characterized by the EPA as “slightly toxic” to freshwater fish, with a LC50 of 13 mg/l (ppm) and “slightly toxic” to freshwater invertebrates (LC50 of 68.3 mg/l). Fish early-life stage and Life-Cycle Aquatic Invertebrate Studies provided Lowest Observed Effect Concentrations (LOECs) of 0.88 mg/l and 18.1 mg/l, respectively (USEPA 1995). In a static tests of the toxicity of picloram acid to cutthroat and lake trout (*Salvelinus namaycush*), the 96 hr LC50's ranged from 25 to 86 mg/l for picloram (Woodward 1976).

In a simulated field study, Mayes (1984) found that concentrations greater than 13 mg/l following rainfall increased fry mortality in cutthroat trout and concentrations greater than 0.61 mg/l decreased growth. No adverse affect was noted from less than 0.29 mg/l (Woodward 1979).

The toxicity of technical picloram, picloram potassium salt, and picloram triisopropanolamine salt to aquatic organisms was evaluated in static acute toxicity tests. Species tested were the fathead minnow, rainbow trout, bluegill, and the daphnia (*Daphnia magna*). Rainbow trout was the most sensitive species tested with LC50 96 hour median lethal concentrations of 19.3, 48, and 51 mg/l for the three picloram forms, respectively (all "slightly toxic" ratings). These LC50 values are 36-fold greater than picloram concentrations detected in freshwater following application to experimental watersheds (toxnet HSDB website).

Woodward (1976) found that the rate of yolk sac absorption and growth of lake trout fry was reduced in flow-through tests at concentrations as low as 0.35 mg/l of picloram. His research also indicated that chronic toxicity on early life stages of lake trout is more significant than might be anticipated on the basis of only acute tests with fingerlings (Woodward, 1976).

Picloram is not expected to accumulate appreciably in aquatic organisms; the measured bioconcentration factor in bluegill sunfish was less than 0.54 (Extonet website, USDA 2001).

It should be noted that although most grasses are resistant, picloram is highly toxic to many non-target plants. The potential for damaging riparian habitat by spraying too close to a riparian buffer is present. Picloram is persistent in the environment, and may exist at levels toxic to plants for more than a year after application at normal rates.

One study examined persistence, rainfall induced migration, potential contamination of surface and groundwater, and losses by photodegradation by following treatment sites for 445 days. Picloram was applied to control spotted knapweed on two sites in the Northern Rockies. Two sites were selected to represent best case and worst case conditions for on site retention of picloram. A valley bottom was treated with 0.28 kg/ha in the spring of 1985 and sampled over 445 days. In the spring of 1986, picloram was applied to both sides of a minimal construction logging road extending four kilometers (km) along a stream draining a granitic upper mountain watershed. Of the 17.1 square km watershed, 0.15% was sprayed. Vegetation, soils, surface water, and groundwater near the road were sampled during the 90 days following application. After 90 days, 78% of the picloram remained in the mountain watershed. It was not detected in the surface water or the groundwater during the 90 days after application. At the valley bottom site, 36, 13, and 10.5% of the picloram persisted after 90, 365, and 445 days. It was concluded that loss by photodegradation was an important factor at both sites during the first seven days (toxnet HSDB website)

Environmental fate data indicate that picloram is mobile and persistent in laboratory and field studies (USEPA, 1995). Picloram is classified as moderately to highly persistent in the soil environment, with field half-lives generally from 20 to 300 days. However, some experiments show persistence exceeding five years. The estimated average is 90 days. Photodegradation is significant only on the soil surface and volatilization is insignificant. Degradation by microorganisms is mainly aerobic, and dependent upon application rates. Increasing soil organic matter increases the sorption of picloram and increases the soil residence time. Picloram adsorbs to clay and organic matter and is highly soluble in water. Picloram is poorly bound to soils lacking clay or organic matter, and can be leached out of the soil. These properties, combined with its persistence, mean it may pose a risk of groundwater contamination. Picloram has been detected in the groundwater of eleven states at concentrations ranging from 0.01 µg/l to 49 µg/l [9] (Extoxnet, USDA 2001).

Picloram can be carried by surface run-off water, since it is water soluble. If released to water, will not appreciably adsorb to sediments, and will not evaporate, or readily hydrolyze. It is subject to photolysis (chemical decomposition by the action of the radiant energy), if it is near the water's surface, with reported half-lives ranging from 2.3 to 41.3 days. In laboratory studies, sunlight readily broke down picloram in water, with a half-life of 2.6 days. In the field, herbicide levels in farm ponds were one mg/l following spraying and decreased to 0.01 mg/l within 100 days, primarily due to dilution and sunlight (Extoxnet website, toxnet HSDB Website).

Picloram may used alone or mixed into formulations with 2,4-D and applied on deep-rooted perennials on non-cropland, and as pellets or in combination with 2,4-D or 2,4,5-T for brush control. Emulsifiable concentrate: 10.2% + 39.6% 2,4-D (0.54 lb AE picloram/gal); Soluble concentrate/liquid (water): 10.2% + 39.6% 2,4-D (0.54 lb AE picloram/gal); Liquid ready to use: 5.4% + 20.9% 2,4-D (0.25 lb AE picloram/gal).

Exposing coho salmon smolts to Tordon 101 (Picloram and 2,4-D) at 0.6 - 1.8 mg/l for 96 hours prevented successful migration upon release (Wedemeyer 1980).

2.1.5.5 Glyphosate

Glyphosate, or N-(phosphonomethyl)glycine, isopropylamine salt, commonly known as Pondmaster®, Ranger®, Roundup®, Rodeo®, and Touchdown® is registered by the EPA as a GUP. It may be used in formulations with other herbicides (Extoxnet website at: http://ace.orst.edu/cgi-bin). Glyphosate is a broad-spectrum, nonselective systemic herbicide used to control grasses, herbaceous plants including deep rooted perennial weeds, brush, some broadleaf trees and shrubs, and some conifers. The registered use rate is 0.3 to 4.0 lbs of active ingredient per acre and may be applied by aerial spraying; spraying from a truck, backpack or hand-held sprayer; wipe application; frill treatment; or cut stump treatment. It is absorbed by leaves, moves rapidly through the plant, acting to prevent production of an essential amino acid that inhibits plant growth. In some plants, glyphosate is metabolized or broken down while other plants do not break it down (Extoxnet website at: http://ace.orst.edu/cgi-bin; USDA 2001).

Glyphosate itself is an acid, but it is commonly used in salt form (isopropylamine salt). It may also be available in acidic or trimethylsulfonium salt forms. It is generally distributed as water-soluble concentrates and powders (Extoxnet website at: http://ace.orst.edu/cgi-bin).

Most commercially-produced glyphosate, such as Accord® and Rodeo®, contain essentially glyphosate (41.5%) and water (58.5%), although some brands, such as Roundup®, include a surfactant (polyethoxylated tallowamine surfactant, 15%) (USDA 2001)

Glyphosate acid and its salts are classified as "moderately toxic" compounds by the EPA. Technical glyphosate acid (parent compound) is "practically nontoxic" to fish and may be "slightly toxic" to aquatic invertebrates. The 96-hour LC50 is 86-140 mg/l in rainbow trout and 120 mg/l in bluegill sunfish. The 48-hour LC50 for glyphosate in daphnia (water flea), an important food source for freshwater fish, is 780 mg/l. The results of a rainbow trout yolk-sac 96-hour LC50 static bioassay yielded results at the 3.4 mg/l level (USGS acute toxicity database website).

There is a very low potential for the compound to build up in the tissues of aquatic invertebrates or other aquatic organisms (Extoxnet website). In one study of bioaccumulation and persistence, glyphosate was applied to two hardwood communities in Oregon coastal forest and none of the 10 coho salmon fingerlings analyzed had detectable levels of the herbicide or its metabolite aminomethylphosphonic acid, although levels were detectable in stream water for three days and in sediment throughout the 55-day monitoring period (toxnet HSDB website).

Looking at the different formulations, the Accord® and Rodeo® formulations are practically nontoxic to freshwater fish (LC50 = >1,000 ppm) and aquatic invertebrate animals (LC50 = 930 ppm for *Daphnia*). The Roundup® formulation, which contains the surfactant, is moderately to slightly toxic to freshwater fish (LC50 = 5-26 ppm) and aquatic invertebrate animals (LC50 = 4-37 ppm for *Daphnia*). Glyphosate and its formulations have not been tested for chronic effects in aquatic animals (USDA 2001). The EPA conducted surfactant testing for both coldwater and warmwater fish for glyphosate (1993). The application rate used was lower than for technical glyphosate. A formulation of 41.2% isopropylamine salt and 15.3 "AA" surfactant provided a rainbow trout LC50 of 120 mg/l, which is practically nontoxic. Bluegill sunfish experienced similar results, with a LC50 of greater than 180 mg/l. The bluegill and rainbow trout were found to be similar in sensitivity to the glyphosate formulation containing the "W" surfactant, with LC50 values of 150 and >100 mg/l, respectively. Neither rainbow trout (LC50 of 240 mg/l) nor bluebill (LC50 of 830 mg/l) were very sensitive to the x-77 (.5) surfactant and glyphosate (7.03%) (USEPA 1993).

The surfactant MON0818 was tested separately, producing an LC50 of 13 mg/l for channel catfish, indicating that it is slightly toxic for catfish, who appear to be the most tolerant of this surfactant. Rainbow trout are the most sensitive, with a LC50 of 0.65 mg/l, classifying this as highly toxic. Based upon the available data, products containing MON0818 must include the statement: "This pesticide is toxic to fish" (USEPA 1993).

In the aquatic environment with freshwater fish, toxicity appears to increase with increasing temperature and pH. As reported in the Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates (USFWS 1980), glyphosate was twice as toxic to rainbow trout at 17 degrees Celsius than at seven degrees Celsius. With bluegills, toxicity was twice as toxic at 27 degrees Celsius compared to 17 degrees Celsius. Toxicity was also two to four times greater to bluegills and rainbow trout at a pH level of 7.5 to 9.5 than at pH 6.5 (PH of 7.0 is considered "neutral water"). However, the EPA states (1993) that glyphosate is stable at pH 3, 6, 9 at 5 and 35 Environmental Concentration.

Glyphosate is classified as moderately persistent in soil, with an estimated average half-life of 47 days. Field half-lives range from one to 174 days. It is strongly adsorbed to most soil types, including types with low organic and clay content. Therefore, even though it is also highly soluble in water, it has a low potential for runoff (except as adsorbed to colloidal matter) and leaching. One study estimated that 2% of the applied chemical was lost to runoff.

Microbes appear to be the primary pathway for degradation of phyphsate (biodegradation), while volatilization or photodegradation (photolysis) losses are negligible (Extoxnet website). Under laboratory conditions, glyphosate has been rapidly and completely biodegraded by soil microorganisms under both aerobic and anaerobic conditions. In one study, after 28 days under aerobic conditions, 45-55% of the glyphosate was mineralized using Ray silt loam soil, Lintonia sandy loam soil, and Drummer silty clay loam soil. Norfolk sandy loam mineralized glyphosate at a much slower, but still significant, rate. Under anaerobic conditions, 37.3% of glyphosate incubated with Ray silt loam soil (toxnet HSDB website). Data indicate half-life values of 1.85 and 2.06 days in Kickapoo sandy loam and Dupo silt loam, respectively (USEPA 1993).

Although glyphosate has a low propensity for leaching, it can enter waterbodies by other means, such as overspray, drift, or erosion of contaminated soil. Once in water, glyphosate is strongly adsorbed to any suspended organic or mineral matter and is then broken down primarily by microbes. Sediment adsorption and/or biodegradation represents the major dissipation process in aquatic systems. Half-lives in pond water range from 12 days to 10 weeks (Extoxnet website).

Evidence from studies suggest that glyphosate levels first rise and then fall to a very low, or even undetectable level, in aquatic systems. After glyphosate was sprayed over two streams in rainy British Columbia, levels in the streams rose dramatically after the first rain event, 27 hour post-application, and fell to undetectable levels 96 hours post-application. The highest glyphosate residues were found in sediments, indicating strong adsorption characteristics of this herbicide. Residues persisted for the entire 171-day monitoring period. It was found that suspended sediment is not a major mechanism for glyphosate transport in rivers (toxnet HSDB website).

Questions have been raised about the role photodegradation plays once glyphosate is in a waterbody, particularly when laboratory versus field conditions are involved. The EPA states in the Registration Eligiblity Document (1993) that glyphosate is stable to photodegradation in pH 5, 7, and 9 buffered solutions under natural sunlight.

2.1.5.6 Likelihood That an Herbicide Will Enter Salmon Habitat

Forest and rangeland practices, including the use of herbicides, are normally conducted in accordance with best management practices (BMPs). These BMPs are intended to ensure that water quality is not put at risk. In the area of herbicide application, this is done by attempting to provide adequate controls of the sources of herbicide contact with waterbodies. The variety of sources include atmospheric deposition, spray drift, surface water runoff, groundwater contamination and intrusion, and direct application. In addition, timing and patterns of herbicide use determine the ability to limit the risk to water contact.

Direct effects resulting from dicamba, 2,4-D, picloram, and glyphosate are associated with contamination of waterways resulting from drift, leaching, and surface water run-off. Drift is primarily dependent upon gravity, air movement, and droplet size. The smaller a droplet, the longer it stays aloft in the atmosphere. In still air, a droplet of pesticide the size of 100 microns (mist-size) takes 11 seconds to fall 10 feet. The same size droplet travels 13.4 feet in a one mph wind, and 77 feet in a five mph wind while dropping 10 feet. Application pressure, nozzle size, nozzle type, spray angle, spray volume are all factors in determining droplet size. In general, droplet sizes increase with decreasing pressure and larger nozzle sizes (NebGuide website at http://www.ianr.unl.edu/pubs/pesticides). An indicated droplet size (*i.e.* 300 microns) really represents a median diameter of all droplets. Actual droplet sizes will range from considerably smaller as well as larger than the indicated droplet size. During temperature inversions little vertical air mixing occurs and drift can translocate contaminates several miles (NebGuide website). Low relative humidity and/or high temperature conditions will increase evaporation and the potential for drift.

Post-application direct effects may occur in association with rain events that may transport the chemicals to waterways, which will convey them downstream to chinook salmon or steelhead habitat. The adsorption potential, stability, solubility, and toxicity of a chemical determines the extent to which it will migrate and adversely affect surface waters and groundwater (Spence *et al.* 1996). Dicamba, and picloram are highly soluble and are readily leached through the soil. Picloram, unlike dicamba, is resistant to biotic and abiotic degradation processes. It can also move from target plants, through roots, down into the soil, and into nearby non-target plants. Given this capability, a sufficient buffer zone is recommended to protect riparian vegetation when using picloram. Glyphosate and 2,4-D, though very soluble, bind well with organic material in soils and therefore are not leached easily. Their solubility lends all four herbicides susceptible to transport in surface runoff, especially if applications are followed immediately with high rainfall events. However, data limitations make it difficult to precisely estimate the degree of ecological risk

While current dogma contends that buffers, application criteria, and concurrent drift monitoring should help minimize the risk of drift and runoff, a study looking at BMP effectiveness found partial effectiveness or ineffectiveness across a variety of applications and monitoring periods (Rashin and Graber 1993). Effectiveness of BMPs for the application of six herbicides was gaged relative to meeting Washington State water quality standards, Washington State forest practice rules, and Washington State Department of Agriculture label restrictions. Rashin and Graber (1993) determined that numerous factors influenced the effectiveness of BMPs including: Streamflow regimes; application equipment and operating parameters; relationships between streamflow and operating factors (*e.g.* nozzle configuration); decisions about buffer size or necessity; weather, herbicide used; and topography and other site factors. The authors concluded that improvements to all BMPs were necessary to ensure achievement of water quality standards, and adherence to forest practice rules and product label restrictions. They proposed changes to buffering provisions, more effective measures for determining the presence of surface water in ephemeral streams, specifications on the type of nozzle configurations and orientations, and operational restrictions based on weather conditions (Rashin and Graber 1993).

One tool that has been used to predict the transport of herbicides to salmon habitat is environmental fate and transport modeling. The science of herbicide spray drift modeling in the forestry context is not well developed (Thistle, personal communication, 2001). Hence, the ability to accurately predict herbicide spray drift or runoff potential is poor. While a few general agricultural spray drift models exist, such as the EPA AGDRIFT model which evaluates spray drift in the near-field, and a three-dimensional Gaussian model used to calculate drift from gases, they are ineffective at capturing the effects drift and runoff in the forested environment. For example, the AGDRIFT model does not take forest canopy cover, droplet runoff of different foliar types, and typical forest topography into account. To date, the USFS has been able to relate the efficacy of the percent of spray hitting the target (Thistle, personal communication, 2001). However, they have not correlated those data with water quality monitoring data to determine whether efficacy predictions can act as a surrogate for water quality controls.

Environmental fate models have not been run on the four herbicides, dicamba, 2,4-D, picloram, and glyphosate, to determine their persistence in the environment. Studies have revealed that microbial action appears to be the primary factor in degrading all four herbicides in both soil and aquatic environments. They are considered moderately persistent in the soil, but persistence is dependent on many variables. Chemical formulations, amount of organic material, soil type, temperatures, soil depth, rainfall amounts, pH, water content, oxygen content all play a role in determining soil persistence. An environment containing dry soil with low microbial presence, which receives periodic high-intensity rainfall events, will be very susceptible to both leaching and surface runoff of picloram and dicamba. This will also be true to a lesser extent with 2,4-D and glyphosate.

Given the results reported in the literature, and limitations of modeling and existing BMPs, it appears likely that herbicides will enter salmon habitat as a result of the proposed action. Standard BMPs have been shown to be insufficient to completely eliminate drift and runoff, and modeling, despite their complexities, have not been sufficiently developed to be able to predict the risk of spray drift.

2.1.5.7 Likelihood of Indirect Effects

A risk evaluation for indirect effects should be structured around the following question: Given the expected environmental concentrations, bioavailability, and persistence of the herbicide in salmon habitat, what is the evidence that there will be significant negative impacts on primary production, nutrient dynamics, or the trophic structure of macroinvertebrate communities that support a listed species?

In most cases, there will be scientific uncertainties associated with: (1) The fate of herbicides in streams; (2) the resiliency and recovery of aquatic communities; (3) the site-specific foraging habits of salmonids and the vulnerability of key prey taxa; (4) the significance of pesticide mixtures; and (5) the mitigating or exacerbating effects of local environmental conditions. Where appropriate, these and other uncertainties should be identified and addressed on a case-by-case basis for each pesticide formulation (active ingredient and adjuvant). Where uncertainties cannot be resolved using the best available scientific literature, the benefit of the doubt should be given to the threatened or endangered species in question.

It is becoming increasingly evident that the indirect effects of contaminants on ecosystem structure and function are a key factor in determining a toxicant's cumulative risk to aquatic organisms (Preston, 2002). Moreover, aquatic plants and macroinvertebrates are generally more sensitive than fish to the acutely toxic effects of herbicides. Therefore, chemicals can potentially impact the structure of aquatic communities at concentrations that fall below the threshold for direct biological impairment in salmon. The integrity of the aquatic food chain is an "essential biological requirement" for salmon, and the possibility that herbicide applications will limit the productivity of streams and rivers should be considered in an adverse affect analysis.

Human activities that modify the physical or chemical characteristics of streams often lead to changes in the trophic system that ultimately reduce salmonid productivity (Bisson and Bilby, 1998). In the case of herbicides, a primary concern is the potential for impacts on benthic algae. Benthic algae are important primary producers in aquatic habitats, and are thought to be the principal source of energy in many mid-sized streams (Minshall, 1978; Vannote *et al.* 1980; Murphy, 1998). Critically, herbicides can cause significant shifts in the composition of benthic algal communities at concentrations in the low parts per billion (Hoagland *et al.* 1996). Moreover, based on the data available, herbicides have a high potential to elicit significant effects on aquatic microorganisms at environmentally relevant concentrations (DeLorenzo *et al.* 2001). In many cases, however, the acute sensitivities of algal species to herbicides are not known. In addition, Hoagland *et al.* (1996) identify key uncertainties in the following areas: (1) the importance of environmental modifying factors such as light, temperature, pH, and nutrients; (2) interactive effects of herbicides where they occur as mixtures; (3) indirect community-level effects; (4) specific modes of action; (5) mechanisms of community and species recovery; and (6) mechanisms of tolerance by some taxa to some chemicals. Herbicide applications have the potential to impair autochthonous production and, by extension, undermine the trophic support for stream ecosystems. However, existing data gaps make it difficult to precisely estimate the degree of ecological risk.

The potential effects of herbicides on prey species for salmon are also an important concern. Juvenile Pacific salmon feed on a diverse array of aquatic macroinvertebrates (*i.e.* larger than 595 microns in their later instars or mature forms; Cederholm *et al.* 2000). Terrestrial insects, aquatic insects, and crustaceans comprise the large majority of the diets of fry and parr in all salmon species (Higgs *et al.* 1995). Prominent taxonomic groups include Chironomidae (midges), Ephemeroptera (mayflies), Plecoptera (stoneflies), Tricoptera (caddisflies), and Simuliidae (blackfly larvae) as well as amphipods, harpacticoid copepods, and daphniids. Chironomids in particular are an important component of the diet of nearly all freshwater salmon fry (Higgs *et al.* 1995). In general, insects and crustaceans are more acutely sensitive to the toxic effects of environmental contaminants than fish or other vertebrates. However, with a few exceptions (*e.g.* daphniids), the impacts of pesticides on salmonid prey taxa have not been widely investigated. Where acute toxicity for salmonid prey species are available, however, they should be used to estimate the potential impacts of herbicide applications on the aquatic food chain.

The growth of salmonids in freshwater systems is largely determined by the availability of prey (Chapman, 1966; Mundie, 1974). For example, supplementation studies (*e.g.* Mason, 1976) have shown a clear relationship between food abundance and the growth rate and biomass yield or productivity of juveniles in streams. Therefore, herbicide applications that kill or otherwise reduce the abundance of macroinvertebrates in streams can also reduce the energetic efficiency for growth in salmonids. Less food can also induce density-dependent effects *e.g.*, competition among foragers can be expected to increase as prey resources are reduced (Ricker, 1976). These considerations are important because juvenile growth is a critical determinant of freshwater and marine survival (Higgs *et al.* 1995). For example, a recent study on size-selective mortality in chinook salmon from the SR (Zabel and Williams, 2002) found that naturally-reared wild fish did not return to spawn if they were below a certain size threshold when they migrated to the ocean. There are two primary reasons why mortality is higher among smaller salmonids. First, fish that have a slower rate of growth suffer size-selective predation during their first year in the marine environment (Parker, 1971; Healy, 1982; Holtby *et al.* 1990). Growth-related mortality occurs late in the first marine year and may determine, in part, the strength of the year class (Beamish and Mahnken, 2001). Second, salmon that grow more slowly may be more vulnerable to starvation or exhaustion (Sogard, 1997).

In summary, the quality of salmon freshwater habitat is determined by a combination of physical, chemical, and biological factors (Cederholm *et al.* 2000). The transport of herbicides to surface waters is a chemical form of habitat modification that can potentially impair the biological components of a properly functioning aquatic ecosystem. These impacts can, in turn, impair the growth and survival of salmonids.

2.1.5.8 Likelihood of Direct Effects

NOAA Fisheries defines harm as "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns including breeding, spawning, rearing, migrating, feeding or sheltering" (50 CFR 222.102). These behavioral patterns, and their underlying physiological processes, are measured at the scale of individual animals. However, they are essential for the viability and genetic integrity of wild populations. It is important to note that many toxicological endpoints or biomarkers may not have clear implications for the health or performance of individual fish (*e.g.* a small percentage change in the activity of a certain enzyme, an increase in oxygen consumption, the formation of pre-neoplastic hepatic lesions, etc). For these kinds of data, it may not be possible to infer a significant loss of function at higher scales of biological complexity.

An analysis of the direct impacts of herbicides on salmonids should relate the site-specific exposure conditions (*i.e.* expected environmental concentration, bioavailability, and exposure duration) to the known or suspected impacts of the chemical on the health of exposed fish. Where possible, such analyses should consider: (1) The life history stage (and any associated vulnerabilities) of the exposed salmonid; (2) the known or suspected mechanism of toxicity for the active ingredient (or adjuvant) in question; (3) local environmental conditions that may modify the relative toxicity of the contaminant; and (4) the possibility of additive or synergistic interactions with other chemicals that may enter surface waters as a result of parallel or upstream land use activities.

Based on the analysis provided in the BA, and discussed above, it appears that the proposed herbicide use is unlikely to cause fish kills when used according to the EPA label. Therefore, for threatened or endangered salmonids, the vast majority of harmful direct effects are expected to be from sublethal exposure. The possibility of sublethal effects leading to ecological death (Kruzynski *et al.* 1994; Kruzynski and Birtwell, 1994) or other deleterious biological outcomes is a threat to listed species from the proposed action. The toxicological endpoints identified below are generally considered to be important for the fitness of salmonids and other fish species. They include: (1) Direct mortality at any life history stage; (2) an increase or decrease in growth; (3) changes in reproductive behavior; (4) a reduction in the number of eggs produced, eggs fertilized, or eggs hatched; (5) developmental abnormalities, including behavioral deficits or physical deformities; (6) reduced ability to osmoregulate or adapt to salinity gradients; (7) reduced ability to tolerate shifts in other environmental variables (*e.g.* temperature or increased stress); (8) an increased susceptibility to disease; (9) an increased susceptibility to predation; and (10) changes in migratory behavior.

Most of these endpoints (above) have not been investigated for dicamba, picloram and 2,4-D. Information on sublethal effects of glyphosate is available for many of the above endpoints, and of those reported, glyphosate appears to carry a low risk for sublethal effects. Very little is known about potential sublethal effects of dicamba. Reduced growth was noted for picloram (Woodward 1976), and changes in schooling behavior and red blood cells, reduced growth, impaired ability to capture prey, and physiological stress were reported for 2-4,D (HSDB web site; Gomez 1998; Cox 1999). The consequences of these sublethal effects are loss of physiological or behavioral functions the can adversely affect the survival, reproductive success, or migratory behavior of individual fish. Such effects, in turn, can be expected to reduce the viability of wild populations.

Additional endpoints could also be significant if a clear relationship is established between the observed impairment and the "essential biological requirements" of salmonids – *i.e.* the likelihood that the exposed animal will survive the various phases of its life cycle and return to its natal river system to spawn.

2.1.5.9 Physical Effects of Herbicides on Watershed and Stream Function

NOAA Fisheries designates critical habitat based on physical and biological features that are essential to the listed species. Essential features of designated critical habitat include substrate, water quality, water quantity, water temperature, food, riparian vegetation, access, water velocity, space and safe passage. The proposed treatment area will occur within designated critical habitat for SR chinook salmon and steelhead and MCR steelhead. The action area will extend into critical habitat because some applications will occur within RHCAs, and rain events could transport herbicides offsite and downstream.

While risk assessment estimates indicate the project may alter the existing water quality and potentially the prey base of SR salmon, and SR and MCR steelhead, it is expected that implementation of project BMPs as described above would minimize the risk that the included four herbicides and surfactants would reach downstream SR salmon, and SR and MCR steelhead habitats in concentrations sufficient to elicit lethal effects. All effects discussed in the previous sections also apply to critical habitat.

Application buffers will be employed to minimize drift or chemical leaching contamination. The proposed buffer strips should maximize infiltration rates and minimize over-ground flow, but it is unknown how effective they will be in preventing chemicals from entering stream channels. Research has not yet been done on effectiveness of application buffers in steep bunchgrass communities such as those found in the action area.

2.1.6 Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as those effects of "future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." Future Federal actions, including the ongoing operation of hydropower systems, hatcheries, fisheries, and land management activities are being (or have been) reviewed through separate section 7 consultation processes. Therefore, these actions are not considered cumulative to the proposed action.

Farming and ranching are the primary activities on private lands within the action area. Because of the steep and rugged terrain in the Lower Grande Ronde River portion of the action area, agriculture is limited to the plateaus and wider river bottoms. Livestock grazing is the dominant management activity on these private lands. NOAA Fisheries is not aware of any specific future non-Federal activities within the action area that would cause additional impacts to listed species beyond what presently occurs. However, the use of chemical fertilizers, herbicides, or pesticides is likely to occur on state and private lands in the action area as part of normal land management practices, but no specific information is available regarding their use. It is possible that waters contaminated by the proposed action could mix with waters contaminated from non-Federal pesticide use, and harm listed fish through additive or synergistic effects of the chemical mixture. The potential for, and severity of harmful additive or synergistic effects is unknown.

2.1.7 Conclusion

NOAA Fisheries has determined that, when the effects of the subject actions addressed in this Opinion are added to the environmental baseline and cumulative effects occurring in the action area, they are not likely to jeopardize the continued existence of SR spring/summer chinook salmon, SR steelhead or MCR steelhead. Additionally, NOAA Fisheries concludes that the subject actions would not cause adverse modification or destruction of designated critical habitat for SR spring/summer chinook salmon.

The BMPs proposed by the BLM are designed to prevent chemicals from entering water. The herbicides applications will be limited to a small percentage of the proposed action area. For example, the Lower Grande Ronde River subbasin, which contains approximately half of the total Vale District acres proposed for herbicide applications, will receive herbicide treatments on less than 1% of the BLM-administered lands. This is approximately 0.01% of the Lower Grande Ronde River subbasin area, widely spread over BLM's small isolated parcels. In addition, this consultation will be reviewed and updated annually. All new pertinent information learned each year through monitoring or research will be incorporated into the coming year's weed management program.

The proposed action consists of a variety of treatment methods that have different effects. The physical, biological, and cultural noxious weed treatments are unlikely to have measurable effects, due to the small amount of area where these treatments would be applied, and the very limited amount of disturbance to riparian soils and native vegetation communities the treatments are expected to create. Cultural and biological controls have very little potential to effect salmonids or their habitat. Cultural controls are preventive measures to reduce the risk of introduction or dissemination of weeds. They do not involve ground disturbing activities. Biological controls use insects and pathogens determined to be host-specific, highly damaging to targeted species, able to survive in the host's habitat, free of natural parasites, and not likely to be parasitized in the host plant's habitat. Biological controls post no foreseeable risk to salmonids or their habitat. Physical controls involve ground disturbing activities (pulling or cutting of weeds). However, the scope and magnitude of this action is so limited that any effect to salmonids or their habitat is considered negligible. The use of herbicides for noxious weed control is likely to result in take of listed fish in isolated circumstances, due to direct, indirect or cumulative effects on listed salmonid species and other aquatic organisms from the proposed chemical treatments.

Streams affected by the proposed action presently support wild, naturally-reproducing anadromous fish at numbers far below estimated historic levels. Low fish densities occur partly from past and present land use in the action area, and partly from factors outside the area (such as mainstem fish passage conditions, or fluctuations in population size due to ocean conditions). Given these circumstances, actions that significantly perpetuate or worsen conditions affecting the survival and recovery of listed fish might jeopardize the continued existence of listed anadromous fish, or adversely modify critical habitat. The spectrum of potential effects of the proposed weed control activities on listed fish ranges from modest benefits, to adverse effects, depending on case-by-case circumstances such as the toxicity of the particular herbicide, effectiveness of BMPs in keeping chemicals out of the water, or effects of weed persistence on the stream, riparian area, or watershed hydrology at a particular location. Benefits to listed fish might occur in drainages where aquatic organisms are not exposed to toxic herbicide concentrations, and where weed eradication restores vegetation and watershed hydrology altered by the invasive weeds or associated changes in fire frequency. Adverse effects might occur in drainages where aquatic organisms are exposed to toxic concentrations of chemicals, particularly in locations where there is no mitigating benefit to the aquatic environment from reducing adverse effects of noxious weeds.

The likelihood of harm to listed fish from the proposed herbicide use depends on both the toxicity of the product, and the timing, duration, and concentration of chemical exposure. The scientific literature on the four herbicides and their combinations indicates relatively low toxicity, for those particular assays where information is available, however, information on potential toxicity is spotty and incomplete. None of the proposed herbicides have available complete scientific or commercial literature on potential sublethal effects (*e.g.* developmental, endocrine/systemic, or behavioral reactions), or on indirect effects on prey species or primary producers, but the information that is available indicates that harm would occur if fish are exposed to concentrations similar to those reported in the particular studies. NOAA Fisheries defines harm as "...significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including, breeding, spawning, rearing, migrating, feeding or sheltering" (50 CFR 222.102).

Gaps in availability of toxicity assays reported in the literature leave open to question the likelihood of harm that might occur from sub-lethal effects for which no test results have been reported, such as changes in spontaneous swimming activity, swimming capacity, feeding and spawning behavior, or vulnerability to predation (Little *et al.* 1990, and Weis *et al.* 2001). An uncertain level of risk exists from the use of pesticides that have not been thoroughly screened, because sublethal effects, in particular, can occur at concentrations several orders of magnitude below concentrations where lethal effects begin to appear. Of the herbicides proposed for use, glyphosate (Rodeo formulation) has the most complete information available, and is least likely to harm listed fish. For the remaining herbicides, there is spotty information reported on the effects of the product formulations (active ingredient + inert ingredients + surfactant + carrier) on listed fish and other aquatic organisms.

Although there is considerable uncertainty regarding the toxicity of some of the herbicides, the low potential for exposure of listed fish to the herbicides mitigates some of the risk. As with toxic effects, there is some uncertainty about the effectiveness of the BMPs and the amount of chemical expected to reach the water. The scientific literature reviewed in the BA and this

Opinion indicates that BMPs generally reduce the amount of herbicides reaching the water, but don't prevent it from getting in. The BA reports results from generalized fate and transport modeling exercises, which indicate exposure of aquatic organisms to the herbicides for a "typical" BLM action is generally expected to be well-below concentrations that would cause lethal effects (given the caveats in the preceding paragraph), and below concentrations where there are obvious sub-lethal effects. Management standards built into the proposed action are expected to minimize potential exposure, because only modest amounts of chemicals are proposed for use in any given watershed, and the use of no-spray buffers and additional BMPs along stream courses is expected to minimize the amount of chemicals reaching the water. Nevertheless, given the uncertainties of BMP effectiveness and chemical fate and transport modeling predictions, listed fish could be harmed by exposure to herbicide concentrations that cause sublethal, or indirect environmental effects.

Given the relatively modest toxicity of the chemicals and the low levels of expected chemical exposure, adverse effects of herbicide treatment are not expected from "typical" applications, but given the gaps in information on sublethal effects and the effectiveness of BMPs, the proposed herbicide treatments could harm listed fish in certain circumstances, as a result of:
(1) Accidental spills; (2) failure of BMPs to keep chemical concentrations below expected levels; (3) unexpected toxic effects that have not been reported in the scientific literature; (4) additive or synergistic effects of herbicides from the proposed action and herbicides used by non-Federal parties in the action area; or (5) indirect effects on the prey base.

Due to the limited number of riparian acres to be treated each year, the abovementioned effects are expected to be localized and of a short duration. If BMPs are unsuccessful in keeping herbicides from reaching water, effects to listed salmonid are most likely to be sublethal, except in the case of a spill. If a spill was to occur directly into water, lethal effects to list salmonids could occur over an area proportional to the size of the spill. However, NOAA Fisheries believes the chance of this occurring is low. The proposed action is also unlikely to impair physical habitat conditions or processes since total number of riparian acres to be treated each year is low and the treatment areas are not in close proximity. In addition, riparian treatments are mostly limited to spot spraying, which prevents, for the most part, mortality of non-target plants. For these reasons, the proposed action is not expected to have discernable effects on stream function.

2.1.8 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of threatened and endangered species. Conservation recommendations are discretionary measures suggested to minimize or avoid adverse effects of a proposed action on listed species, minimize or avoid adverse modification of critical habitat, and to develop additional information. NOAA Fisheries believes the following conservation recommendations are consistent with these obligations, and therefore should be carried out by the BLM.

1. The BLM should conduct a literature review for all chemicals used in BLM's noxious weed management program with an emphasis on sublethal effects of herbicides on salmon and steelhead.

2. The BLM should develop a long-term, statistically sound, repeatable chemical monitoring program that evaluates the effectiveness and reliability of Best Management Practices designed to minimize chemicals from reaching surface waters, surface-groundwater mixing zones, and non-target vegetation at concentrations that can result in lethal and sublethal effects to salmon and steelhead, and diminish the quality, quantity, and function of riparian vegetation.
    a. The monitoring program should be designed to evaluate different application methods (*e.g.*, aerial vs ground-based), chemical-specific characteristics to include all chemical combinations used for noxious weed management, and landscape characteristics. Water, streambed sediments, and soil samples should be collected for each type of treatment, with several replicates for each chemical and treatment type. Samples should include pre- and post-treatment monitoring.
    b. Level of detection for each chemical constituent should be established at concentrations that elicit lethal and sublethal effects to salmon and steelhead. Level of detection should be based on an LC_{10}, not an LC_{50}, for salmon and steelhead.
    c. Level of detection should include active ingredients, inert ingredients, surfactants, emulsifying agents, and wetting agents.

    d. Develop a sampling design for monitoring the persistence of herbicides in riparian soils and to determine concentrations and residence time of herbicides that enter streams and rivers. The sampling design should provide a statistical estimate of chemical exposure, and should be sufficient to determine if the assumptions in this Opinion regarding exposure are correct.

3. The BLM should work with chemical manufacturers to determine toxicity of inert ingredients and adjuvants to salmon and steelhead, cold water macroinvertebrates, and freshwater flora.

4. The BLM should integrate information from the literature review, monitoring program, and efforts carried out with chemical manufacturers into future integrated noxious weed management programs.

In order for NOAA Fisheries to be kept informed of actions minimizing or avoiding adverse effects, or those that benefit listed salmon and steelhead or their habitats, we request notification of the achievement of any conservation recommendations when the UNF submits its annual report describing achievements of the fish monitoring program during the previous year.

2.1.8 Reinitiation of Consultation

Consultation must be reinitiated if: (1) The amount or extent of taking specified in the incidental take statement is exceeded, or is expected to be exceeded; (2) new information reveals effects of the action may affect listed species in a way not previously considered; (3) the action is modified in a way that causes an effect on listed species that was not previously considered; or (4) a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16). In instances where the amount or extent of authorized incidental take is exceeded, any operations causing such take must cease pending conclusion of the reinitiated consultation.

2.2 Incidental Take Statement

Section 9 and rules promulgated under section 4(d) of the ESA prohibit any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct) of listed species without a specific permit or exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, and sheltering. Harass is defined as actions that create the likelihood of injuring listed species by annoying it to such an extent as to significantly alter normal behavior patterns which include, but are not limited to, breeding, feeding, and sheltering. Incidental take is take of listed animal species that results from, but is not the purpose of, the Federal agency or the applicant carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action is not considered prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

2.1 Amount or Extent of Take

NOAA Fisheries anticipates that the proposed action covered by this Opinion is reasonably certain to result in incidental take of SR chinook salmon and SR steelhead, and MCR steelhead because: (1) The proposed action is reasonably certain to kill, or more likely cause harm to, individual salmon and steelhead through lethal and sublethal exposure to herbicides; (2) the proposed action is reasonably certain to adversely affect essential features of critical habitat that would in turn reduce the survival of the subject species; (3) recent and historical data indicates the subject species is known to occur in the action area; and (4) the proposed action is likely to adversely affect availability of invertebrate prey through toxic effects of herbicides that reach streams and rivers based on the analysis described in section 1.5 of this Opinion.

Despite the use of best scientific and commercial data available, NOAA Fisheries cannot quantify a specific amount of incidental take or individual fish or incubating eggs for this action. The amount of take depends on the circumstances at the specific locations where treatments will occur, which are not known at this time, the species present, life stage, and the number of fish present when treatment activities occur. Take (killing) of adult, juvenile, and incubation salmon or steelhead eggs is not authorized under this Opinion. For the purposes of this Opinion, the extent of lethal and non-lethal take is defined as and limited to harm and harassment in the proposed treatment areas in the Lower Grande Ronde River subbasin, Upper Grande Ronde River, Wallowa River, Walla Walla River, North Fork John Day River, and Lower Snake/Asotin subbasins. Each year for the period of FY2003-2013, approximately 50 acres of riparian area treatment would occur.

2.2.1 Reasonable and Prudent Measures

Reasonable and prudent measures are non-discretionary measures to minimize take, that are not already part of the description of the proposed action. They must be implemented as binding conditions for the exemption in section 7(a)(2) to apply. The BLM has the continuing duty to regulate the activities covered in this incidental take statement. If the BLM fails to require contractors to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the contract, or fails to retain the oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse. NOAA Fisheries believes that activities carried out in a manner consistent with these reasonable and prudent measures will not necessitate further site-specific consultation. Activities carried out which do not comply with the reasonable and prudent measures are not covered by this Opinion and will require further consultation.

NOAA Fisheries believes that based on: (1) The lack of sound and reliable scientific data on sublethal effects to salmon and steelhead from exposure to herbicides; (2) the uncertainty of BMP effectiveness; (3) the lack of defined, site-specific treatment areas; and (4) the presence of salmon and steelhead (incubating eggs, juveniles, adults) in the action area during herbicide applications, that the following reasonable and prudent measures are necessary and appropriate to minimize take of SR chinook salmon or SR steelhead, or MCR steelhead resulting from implementation of the action. These reasonable and prudent measures will also minimize adverse effects on designated critical habitat.

The BLM shall:

1. Minimize the extent of incidental take associated with herbicide application by implementing BMPs that minimize herbicides from reaching surface and surface-ground water mixing zones.

2. Monitor the effectiveness of BMPs, conservation recommendations, and terms and conditions designed to minimize incidental take, and submit a report to NOAA Fisheries.

2.2.2 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, BLM must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. To Implement reasonable and prudent measure #1 (Minimize herbicides from reaching surface and surface-ground water mixing zones), the BLM shall ensure that:
   a. All BMPs described in section 1.2.1 of this Opinion are implemented.
   b. Review the BLM spill response procedures outlined in the BLM manual 9011-1 with each applicator before commencing herbicide application operations.
   c. Periodically coordinate schedules during the spray season with the NOAA Fisheries Level 1 team representative to allow NOAA Fisheries the opportunity to observe chemical applications.
   d. All chemical storage, chemical mixing, and post-application equipment cleaning is completed in such a manner as to prevent the potential contamination of any RHCA, perennial or intermittent waterbody, unprotected ephemeral waterway, or wetland.
   e. No aerial applications occur within 300 feet of streams or rivers, and 150 feet from dry, intermittent channels. Spray buffers may be adjusted by the Level 1 team, taking into consideration the location (relative to ESA-listed salmonids), relative toxicity of chemicals used, topography, amount of acreage to be treated, and limitations on road access.
   f. Broadcast spraying is excluded within 100 feet from streams and rivers. Use only those sprayers with a single nozzle, such as back pack or hand sprayers, to spray herbicides in this zone.
   g. Chemical spraying is excluded within 15 feet of stream channels, and within this zone limit herbicide application to techniques that do not require spray applications.
      i. All hand operated application equipment is leak and spill proof.
   h. Herbicide applications are prohibited when precipitation is occurring or forecast to occur within the next 24 hours.
   i. A licensed/certified herbicide applicator is overseeing all spray projects.
   j. Only the minimum area necessary for the control of noxious weeds is treated.
   k. Prohibit helicopter service landings or fuel storage within 300 feet of fish-bearing streams and lakes, 150 feet from other perennial streams, or 100 feet from intermittent streams, springs, seeps, wetlands, or ponds. Where these restrictions are not feasible due to steep terrain or limited accessability, the safest landing or storage sites as far from live water as possible will be used.
   l. Aerial applications are designed to deliver a median droplet diameter of 200 to 800 microns to reduce drift. Apply the coarsest droplet size spectrum possible, and use the lowest nozzle height providing coverage.
   m. Aerial applications are excluded when wind speeds are above 5 miles per hour, or if turbulence is sufficient to affect the normal spray pattern. Ground-based applications are excluded when wind speeds exceed 8 miles per hour.
   n. No carrier other than water will be used for aerial applications.
   o. When using aerial applications, perform a test run before each spray project, on a representative site, to calibrate droplet size and spread, and to determine the extent of drift, as indicated by a series of spray cards placed at a regular interval, perpendicular to the flight path. The representative site shall be reasonably close

to the project site, acceptable to the BLM Project Inspector as well as the vendor and pilot and have reasonable access for placing and retrieving spray cards.

p. All equipment used for transportation, storage, or application of chemicals, including helicopters, be maintained in an area that is constructed to fully contain all chemicals, and not loaded or unloaded within 300 feet of any perennial or intermittent stream or water body.

q. No ester formulations of 2,4-D will be used.

2. To implement reasonable and prudent measure #2 (monitoring), the BLM shall ensure that:

a. The District will conduct implementation monitoring on projects within RHCAs to provide information to NOAA Fisheries to track actions in the environmental baseline. The monitoring program will use the existing IIT "Report Card" system in place for other BLM activities in the PACFISH/INFISH area.

b. Effectiveness monitoring will be limited to the use of spray cards and/or dyes to evaluate efficacy of BMPs for eliminating chemical application in non-target areas. Aerial application adjacent to riparian areas are of higher concern to NOAA because of spray drift, and hence will have a higher sampling frequency where there is reasonable access. Actual sampling strategies will be determined by the IDT (communicating with the Level 1 team) on an annual basis, based upon treatment area, herbicide, location, and number of treated patches, but will be consistent with the sample size described in term and condition 2.c.

c. Non-target plant mortality in riparian areas will be monitored if mortality of non-target plants is affecting riparian function.

d. Spray cards, dye, or other type of indicator to monitor chemical drift will be used at the water's edge on a small sample (no less than five sites) of riparian treatment areas. These indicators will provide visual verification that the application methods are minimizing risk to listed fish species. Findings from these indicators will be included in the annual monitoring results.

e. Prior to beginning treatment each year, provide NOAA Fisheries with a list of the following information for each locations to be treated:

    i. Acres to treated
    ii. Riparian acres to be treated
    iii. Application method
    iv. Herbicide to be used
    v. Approximate time of treatment

f. Monitoring results will be reported to NOAA Fisheries (Randy Tweten 541.975.1835, ext.229) after the field season and before weed control activities if similar activities are proposed in subsequent years.

g. If a listed species specimen is found dead, sick, or injured, as a possible result of the proposed action or other unnatural cause, initial notification should be made to the NOAA Fisheries Law Enforcement Office, in the Vancouver Field Office, 600 Maritime, Suite 120, Vancouver, Washington 98661; or call: 360.418.4226.

Care should be taken in handling sick or injured specimens to ensure effective treatment and care. Dead specimens should be handled to preserve biological material in the best possible state for later analysis of cause of death. With the care of sick or injured listed species ir preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not disturbed.

3. MAGNUSON-STEVENS ACT

3.1 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), requires the inclusion of EFH descriptions in Federal fishery management plans. In addition, the MSA requires Federal agencies to consult with NOAA Fisheries on activities that may adversely affect EFH.

EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (MSA §3). The Pacific Fisheries Management Council (Council) has designated EFH for federally-managed groundfish (PFMC 1998a), coastal pelagic (PFMC 1998b), and Pacific salmon (PFMC 1999) fisheries.

The MSA requires consultation for all actions that may adversely affect EFH, and does not distinguish between actions within EFH and actions outside EFH. Any reasonable attempt to encourage the conservation of EFH must take into account actions that occur outside EFH, such as upstream and upslope activities, that may have an adverse effect on EFH. Therefore, EFH consultation with NOAA Fisheries is required by Federal agencies undertaking, permitting or funding activities that may adversely affect EFH, regardless of its location.

The consultation requirements of section 305(b) of the MSA (16 U.S.C. 1855(b)) provide that:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH;
- NOAA Fisheries shall provide conservation recommendations for any Federal or state activity that may adversely affect EFH;
- Federal agencies shall, within 30 days after receiving conservation recommendations from NOAA Fisheries, provide a detailed response in writing to NOAA Fisheries regarding the conservation recommendations. The response shall include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the conservation recommendations of NOAA Fisheries, the Federal agency shall explain its reasons for not following the recommendations no less than 10 days before granting final authorization for the subject action.

3.2 Identification of Essential Fish Habitat

Groundfish and coastal pelagic EFH extend from tidal submerged environments within Washington, Oregon, and California offshore to the exclusive economic zone limit (200 miles) (PFMC 1998a; PFMC 1998b). A description and identification of EFH for salmon is found in Appendix A of Amendment 14 to the *Pacific Coast Salmon Plan* (PFMC 1999). The EFH includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to chinook salmon and coho salmon in Washington, Oregon, Idaho, and California, except above the impassable barriers identified by the Council (PFMC 1999). Chief Joseph Dam, Dworshak Dam, and the Hells Canyon Complex (Hells Canyon, Oxbow, and Brownlee Dams) are among the listed man-made barriers that represent the upstream extent of the Pacific salmon fishery EFH. Salmon EFH excludes areas upstream of longstanding, naturally-impassable barriers (*i.e.* natural waterfalls in existence for several hundred years). In the estuarine and marine areas, proposed designated salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (200 miles) offshore of Washington, Oregon, and California north of Point Conception to the Canadian border (PFMC 1999).

3.3 Proposed Actions

The proposed action is detailed above in section 1.2 fo this Opinion. The action area encompasses the area immediately associated with the subject herbicide application on the BLM Vale District, as well as points downstream that may experience chemical contamination.

3.4 Effects of the Proposed Action

NOAA Fisheries concludes that the effects of this project on designated EFH are likely to be within the range of effects considered in the ESA portion of this consultation, and finds that the proposed herbicide application will adversely affect EFH designated for chinook salmon.

3.5 Conclusion

NOAA Fisheries believes that the proposed action will adversely affect designated EFH for chinook salmon.

3.6 EFH Conservation Recommendations

The conservation recommendations presented above in section 2.1.8, and the reasonable and prudent measures and corresponding terms and conditions outlined above in section 2.2.1 and 2.2.2 are applicable to designated chinook salmon EFH. Therefore, NOAA Fisheries recommends that they be adopted as EFH conservation measures. Should BLM adopt and implement these recommendations, potential adverse impacts to EFH would be minimized.

3.7 Statutory Response Requirements

Please note that the MSA(§305(b)) requires the Federal agency to provide a written response to NOAA Fisheries' EFH conservation recommendations within 30 days of its receipt of this letter and 10 days before final authorization of the proposed action. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity. If the response is inconsistent with NOAA Fisheries' conservation recommendations, the reasons for not implementing them must be included.

3.8 Consultation Renewal

BLM must reinitiate EFH consultation with NOAA Fisheries if the action is substantially revised in a way that may adversely affect EFH or new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920).

4. LITERATURE CITED

Section 7(a)(2) of the ESA requires biological opinions to be based on "the best scientific and commercial data available." This section identifies the data used in developing this Opinion in addition to the BA and additional information requested by NOAA Fisheries and provided by the UNF, WWNF, and MNF.

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5. APPENDIX A

FY2002 Herbicide Applications: ***EXAMPLE***

Drainage Name/code and Description*	Upland Acres Treated	Riparian Acres Treated	Application Method	Product Name	Active Ingredient (AI)	Application Rate (lbs. AI/Ac.)	Timing	Species & Life Stages Affected
Captain John Creek 170601030302								
Upper (above S. Fork)	50		aerial, boom	Tordon/ 2,4-D	Picloram, 2,4-D	0.25 & 1.0	May 1 - June 15	SH - rearing
Lower (below S. Fork)		10	wiping	Rodeo	Glyphosate	.05	twice: May & Aug	SH -egg, rearing CH - rearing

* Use 6th field HUC or smaller, whichever scale best matches application pattern/area